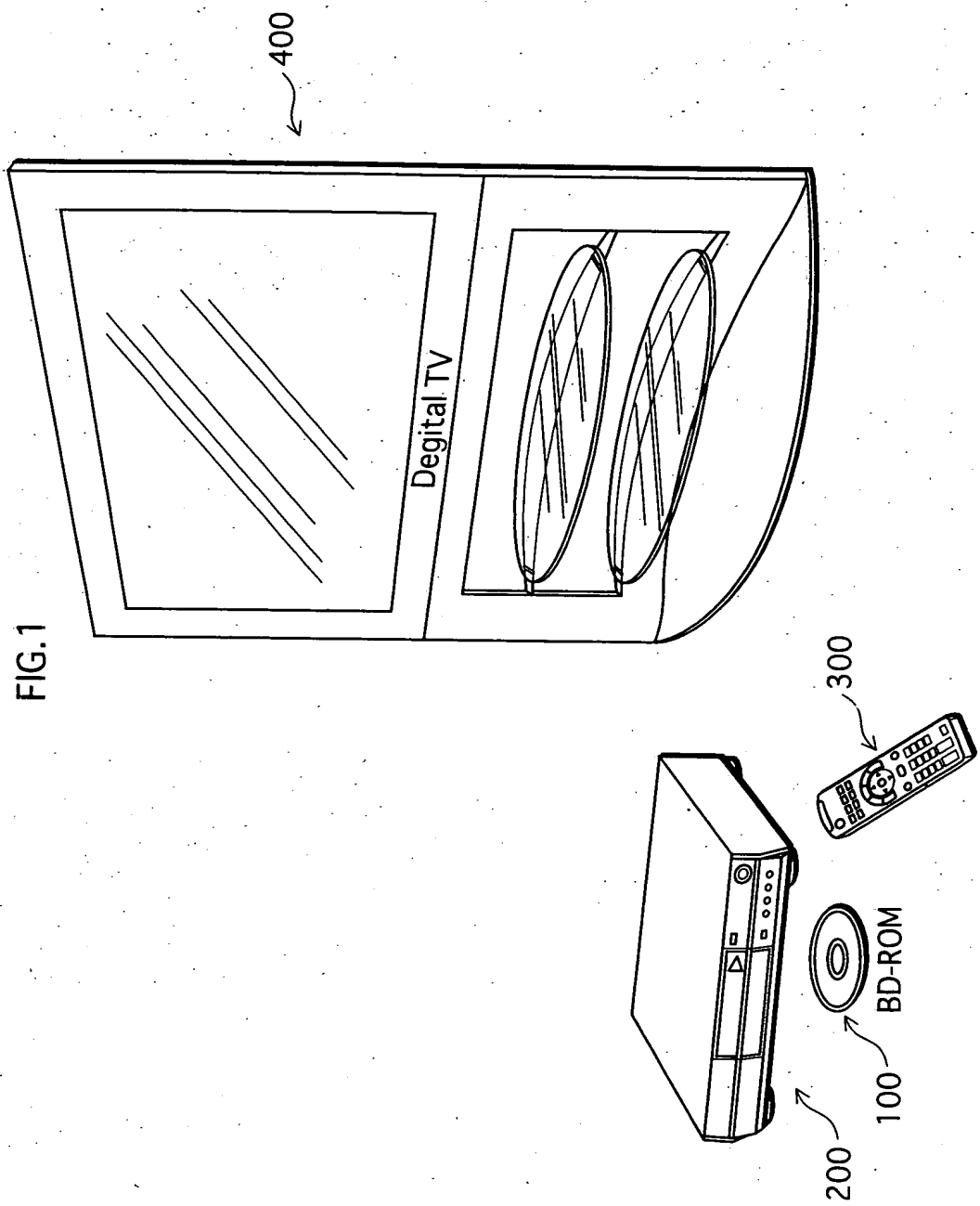


FIG.1

FIG.2

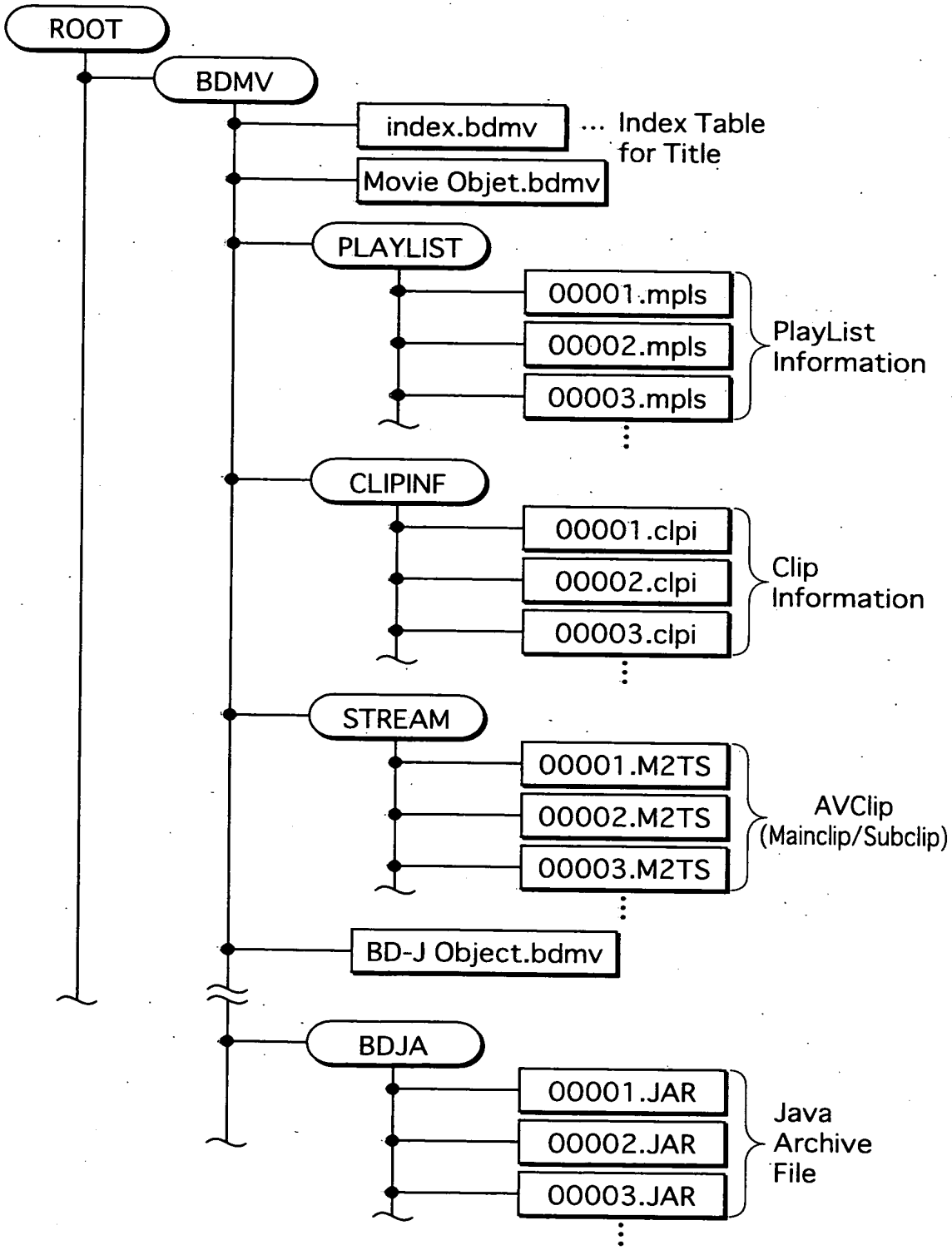

ROOT
BDMV
index.bdmv
... Index Table for Title
Movie Objet.bdmv
PLAYLIST
00001.mpls
00002.mpls
00003.mpls
PlayList Information
CLIPINF
00001.clpi
00002.clpi
00003.clpi
Clip Information
STREAM
00001.M2TS
00002.M2TS
00003.M2TS
AVClip (Mainclip/Subclip)
BD-J Object.bdmv
BDJA
00001.JAR
00002.JAR
00003.JAR
Java Archive File

FIG.3

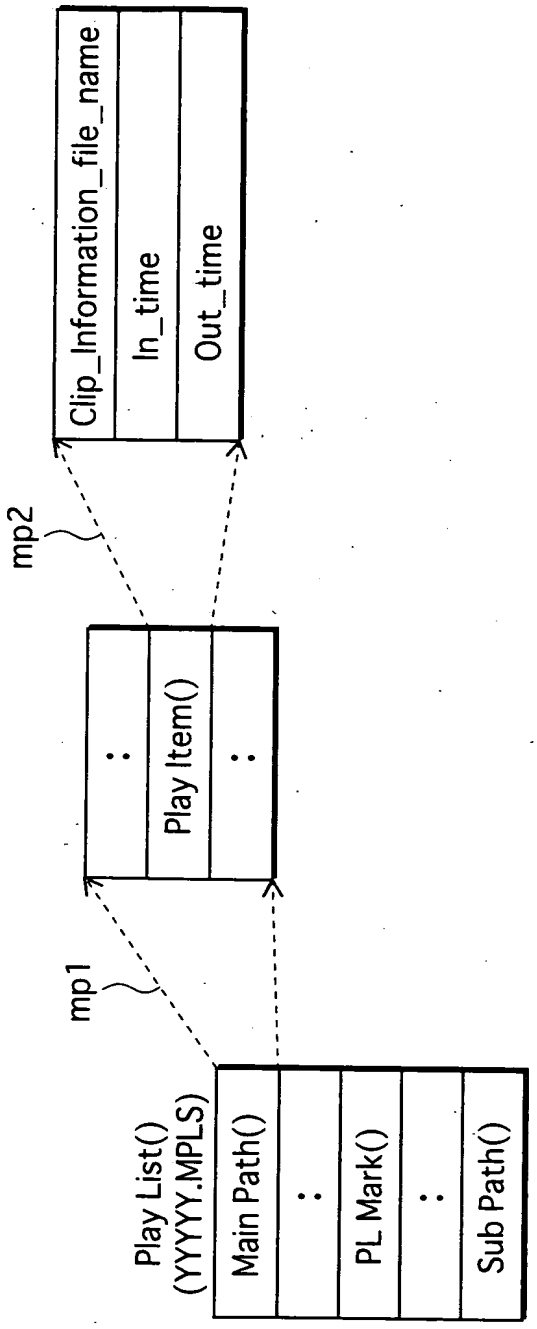

Clip_Information_file_name
In_time
Out_time
mp2
Play Item()
mp1
Play List()
(YYYY.MPLS)
Main Path()
PL Mark()
Sub Path()

FIG.4

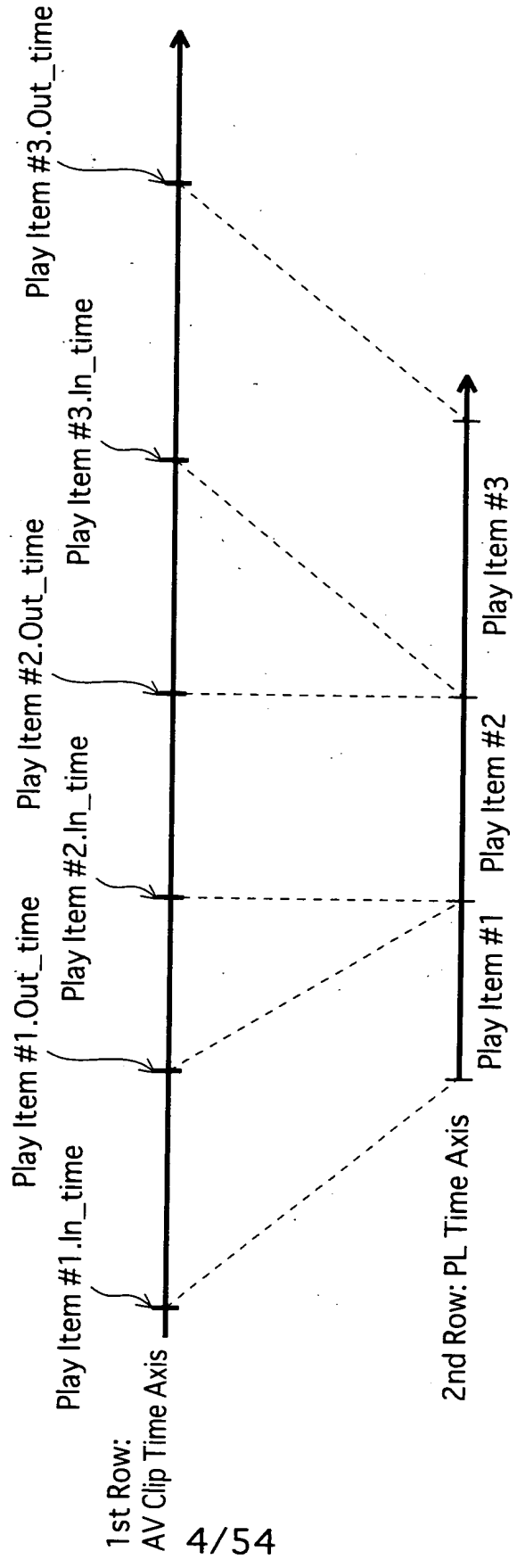

Play Item #3.Out_time
Play Item #3.In_time
Play Item #2.Out_time
Play Item #2.In_time
Play Item #1.Out_time
Play Item #1.In_time
1st Row:
AV Clip Time Axis
2nd Row: PL Time Axis
Play Item #1
Play Item #2
Play Item #3

FIG.5

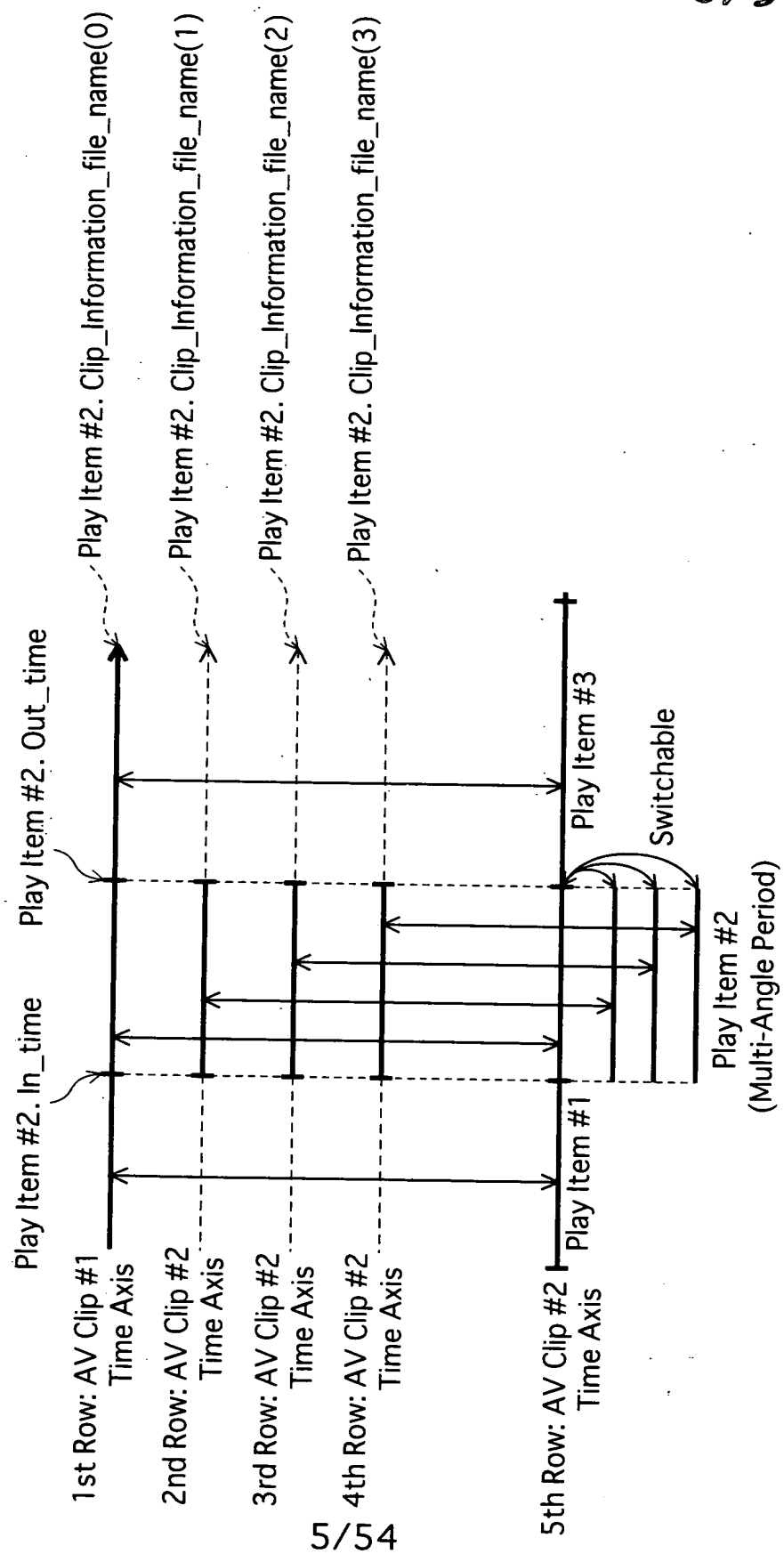

Play Item #2. Clip_Information_file_name(0)
Play Item #2. Clip_Information_file_name(1)
Play Item #2. Clip_Information_file_name(2)
Play Item #2. Clip_Information_file_name(3)
Play Item #2. Out_time
Play Item #2. In_time
Play Item #3
Switchable
Play Item #2
(Multi-Angle Period)
1st Row: AV Clip #1 Time Axis
2nd Row: AV Clip #2 Time Axis
3rd Row: AV Clip #2 Time Axis
4th Row: AV Clip #2 Time Axis
5th Row: AV Clip #2 Time Axis
Play Item #1

FIG.6

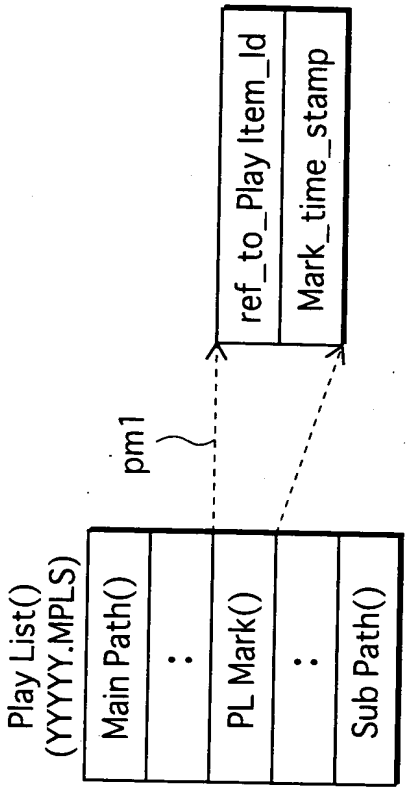

ref_to_Play Item_Id
Mark_time_stamp
pm1
Play List()
(YYYY.MPLS)
Main Path()
PL Mark()
Sub Path()

FIG.7

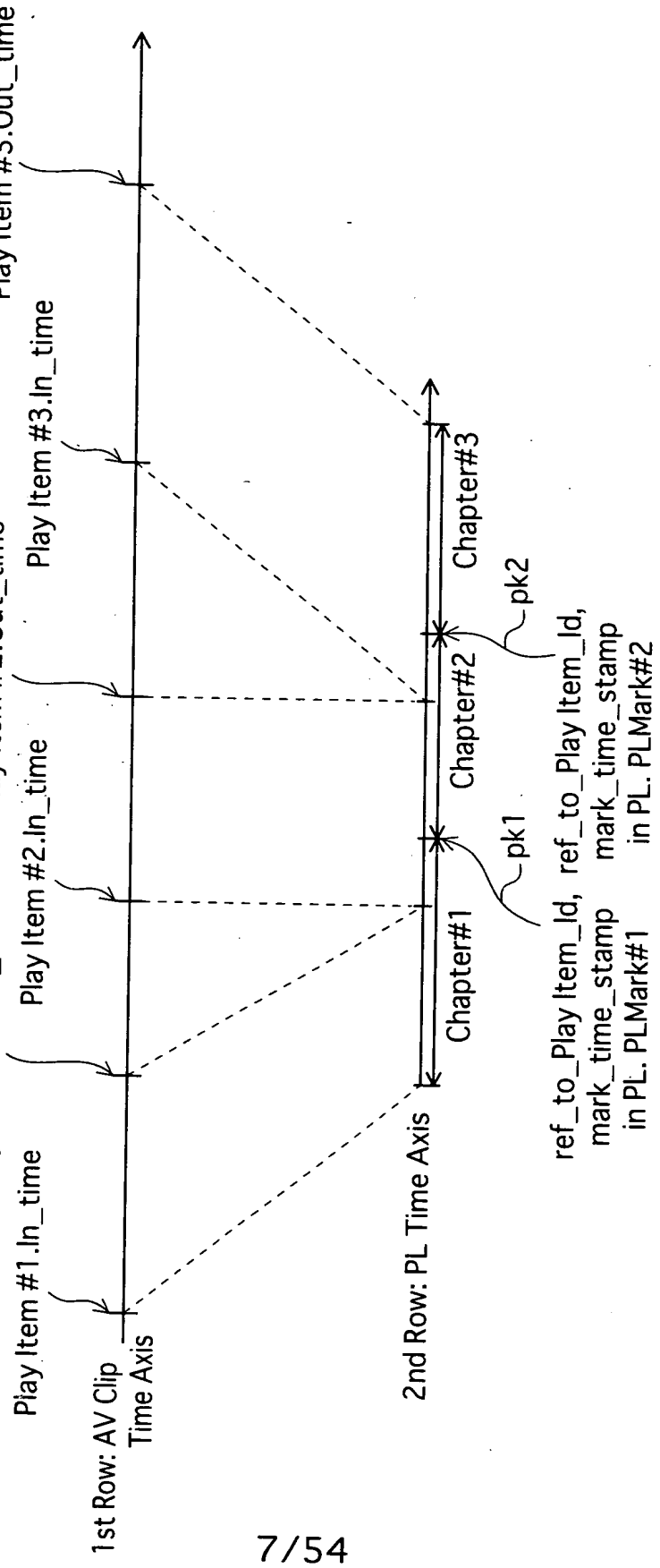

Play Item #3.Out_time
Play Item #3.In_time
Play Item #2.Out_time
Play Item #2.In_time
Play Item #1.Out_time
Play Item #1.In_time
1st Row: AV Clip Time Axis
2nd Row: PL Time Axis
Chapter#1
Chapter#2
Chapter#3
pk1
pk2
ref_to_Play Item_Id, mark_time_stamp in PL. PLMark#1
ref_to_Play Item_Id, mark_time_stamp in PL. PLMark#2

FIG.8

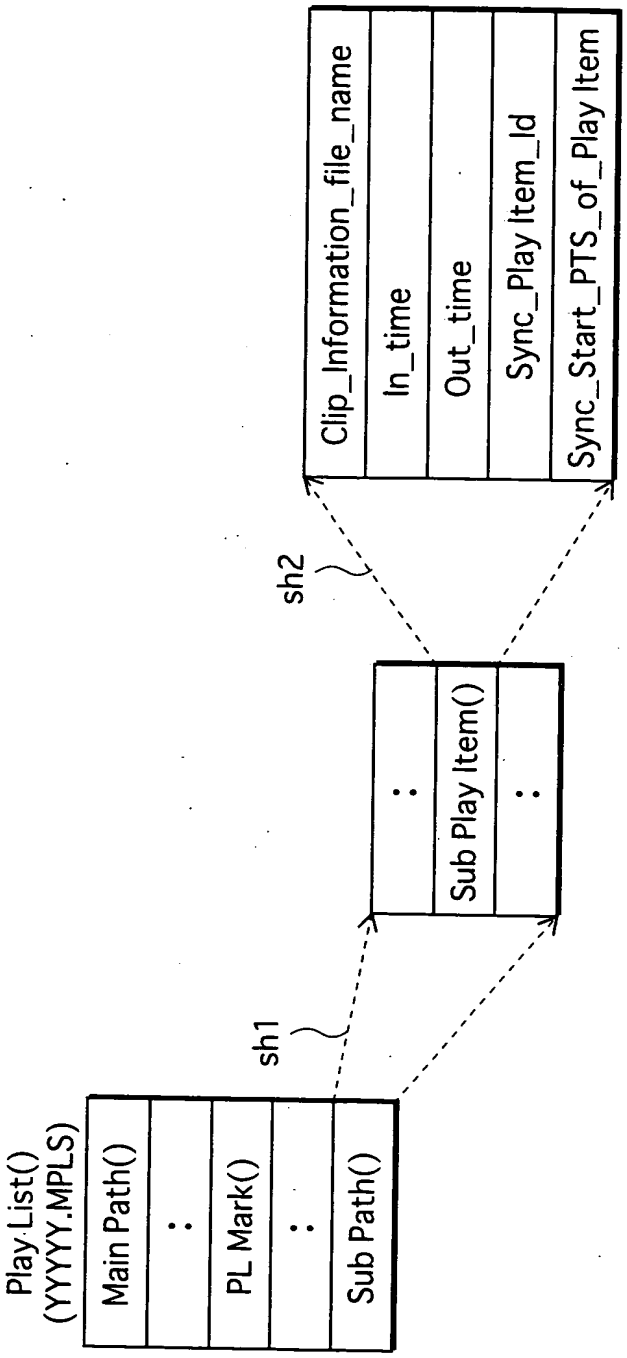

Play List()
(YYYY.MPLS)
Main Path()
PL Mark()
Sub Path()
sh1
Sub Play Item()
sh2
Clip_Information_file_name
In_time
Out_time
Sync_Play Item_Id
Sync_Start_PTS_of_Play Item

FIG.9

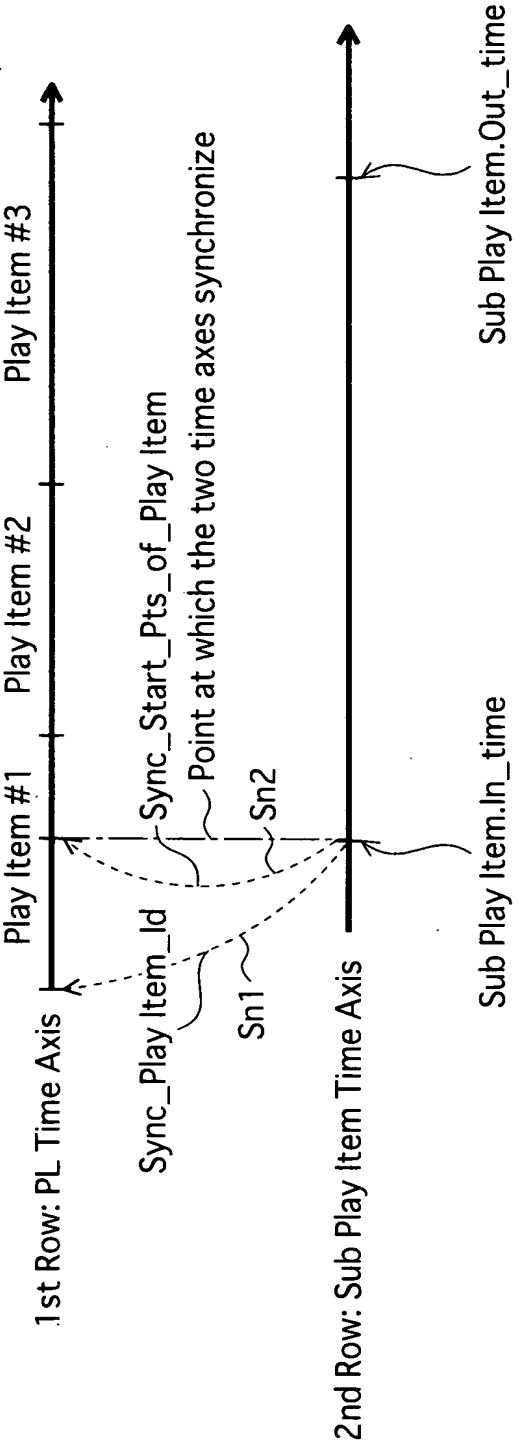

1st Row: PL Time Axis
Play Item #1
Play Item #2
Play Item #3
Sync_Play Item_Id
Sn1
Sync_Start_Pts_of_Play Item
Point at which the two time axes synchronize
Sn2
2nd Row: Sub Play Item Time Axis
Sub Play Item.In_time
Sub Play Item.Out_time

FIG.10

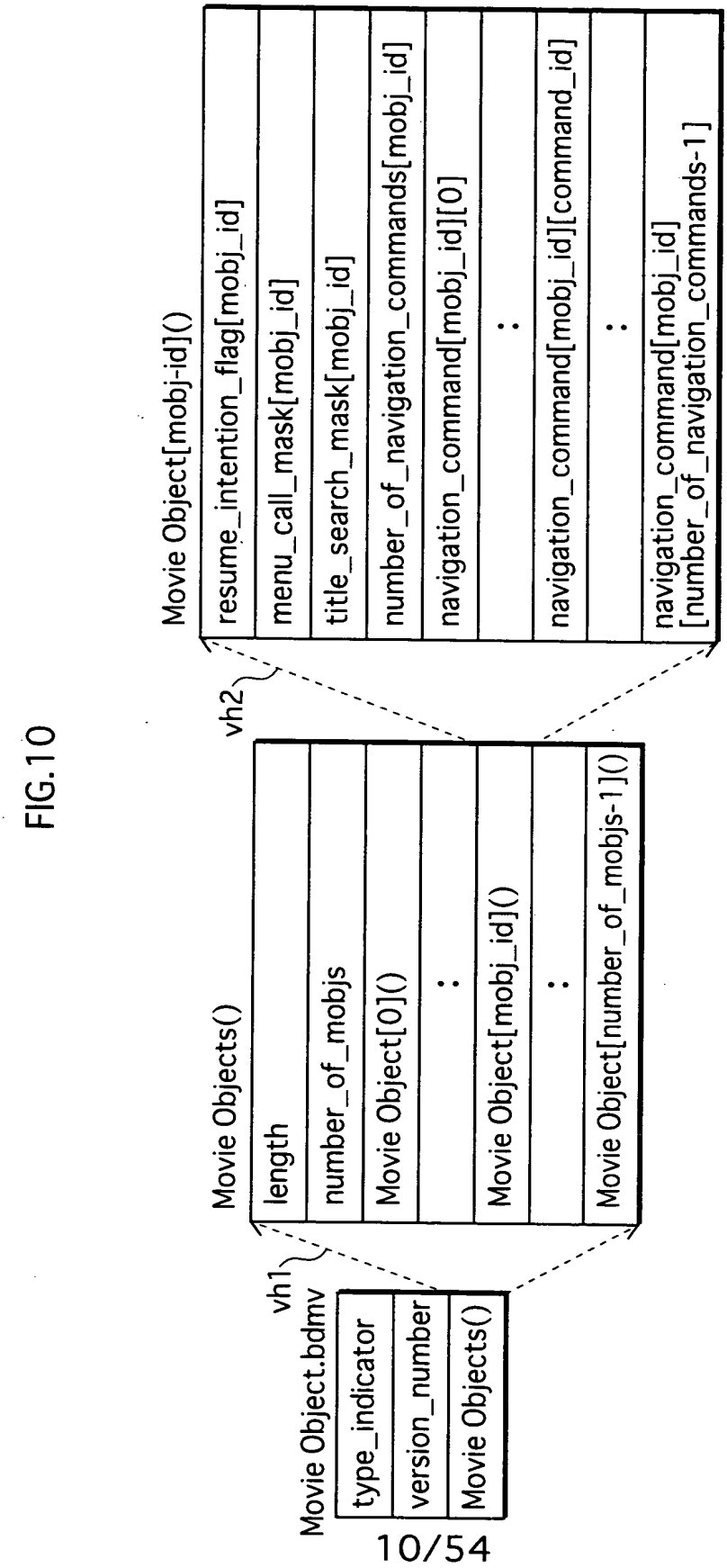

Movie Object.bdmv
type_indicator
version_number
Movie Objects()
vh1
Movie Objects()
length
number_of_mobjs
Movie Object[0]()
:
Movie Object[mobj_id]()
:
Movie Object[number_of_mobjs-1]()
vh2
Movie Object[mobj-id]()
resume_intention_flag[mobj_id]
menu_call_mask[mobj_id]
title_search_mask[mobj_id]
number_of_navigation_commands[mobj_id]
navigation_command[mobj_id][0]
:
navigation_command[mobj_id][command_id]
:
navigation_command[mobj_id]
[number_of_navigation_commands-1]

FIG.11

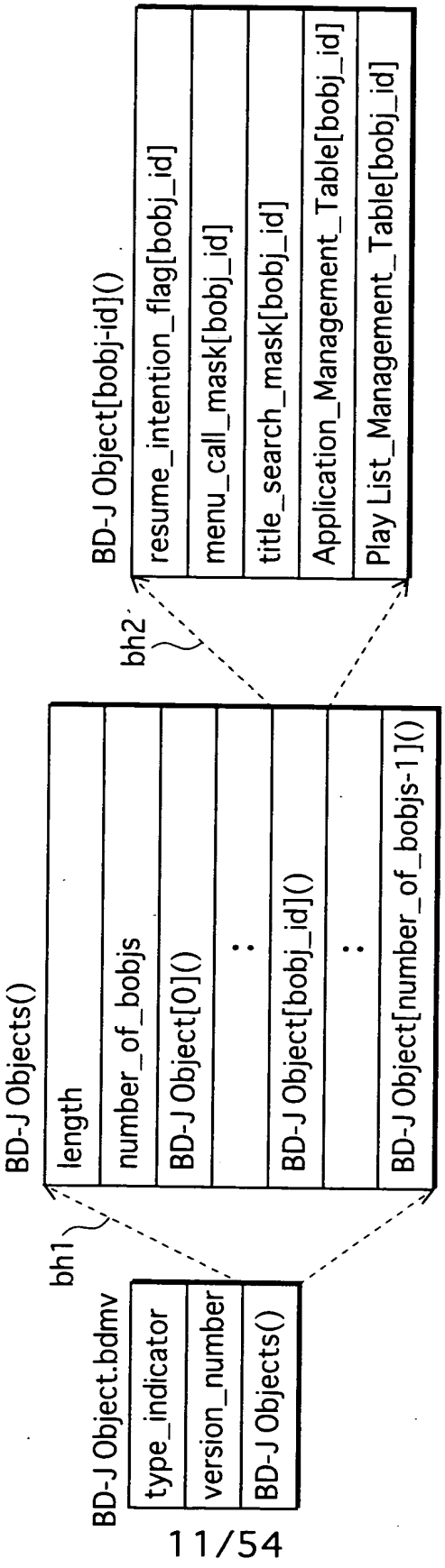

BD-J Object.bdmv
type_indicator
version_number
BD-J Objects()
bh1
BD-J Objects()
length
number_of_bobjs
BD-J Object[0]()
BD-J Object[bobj_id]()
BD-J Object[number_of_bobjs-1]()
bh2
BD-J Object[bobj-id]()
resume_intention_flag[bobj_id]
menu_call_mask[bobj_id]
title_search_mask[bobj_id]
Application_Management_Table[bobj_id]
Play List_Management_Table[bobj_id]

FIG.12A

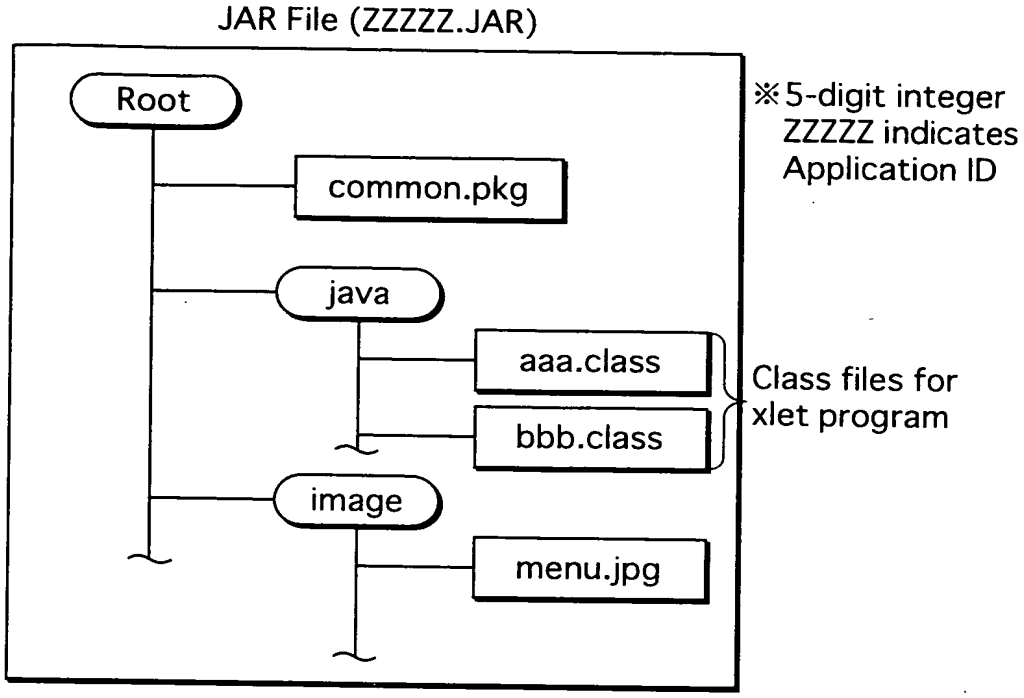


FIG.12B

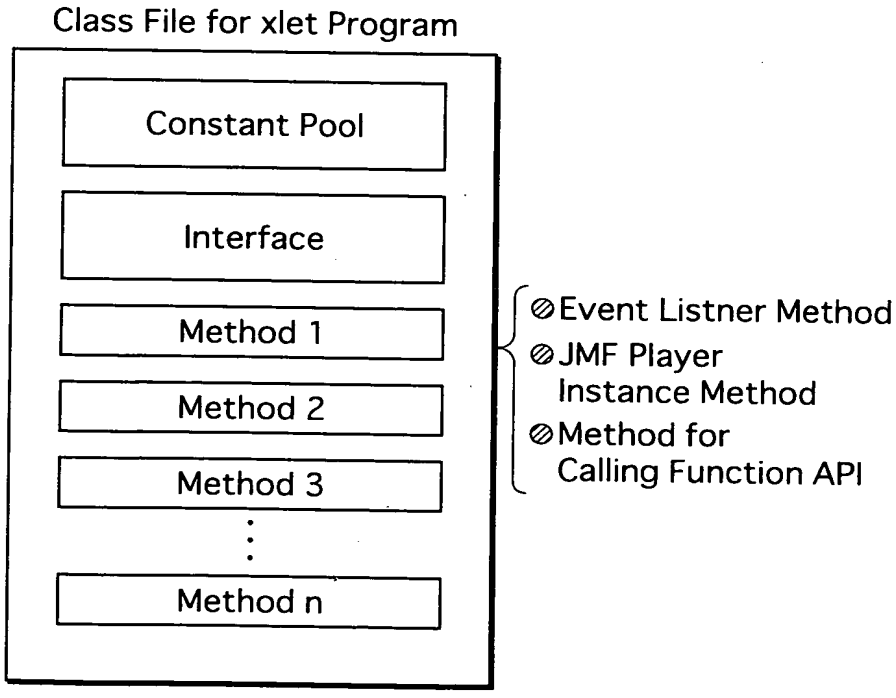


FIG. 13

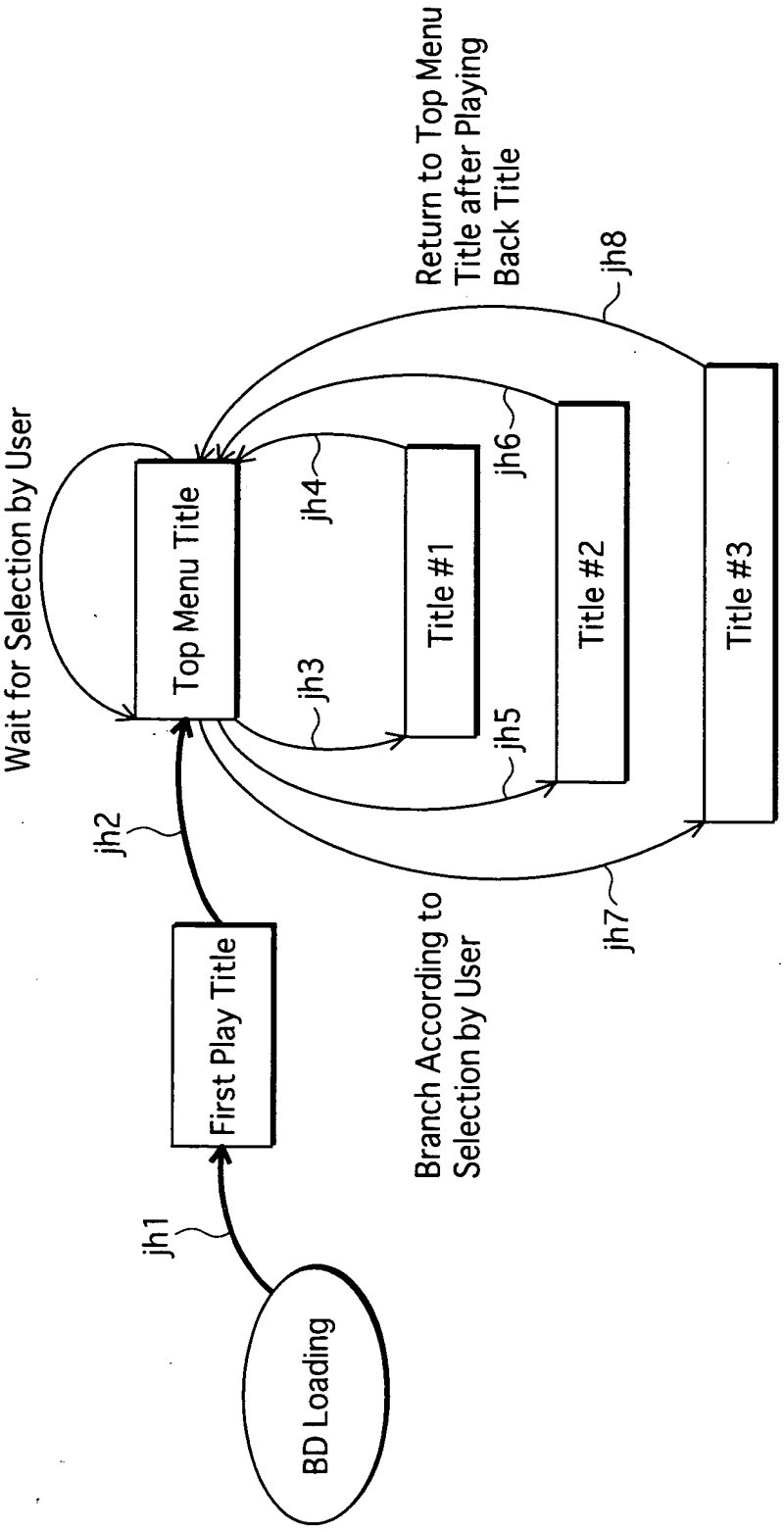

BD Loading
jh1
First Play Title
jh2
Top Menu Title
Wait for Selection by User
jh3
jh4
Title #1
jh5
Title #2
jh6
Title #3
jh7
Branch According to Selection by User
jh8
Return to Top Menu Title after Playing Back Title

FIG.14

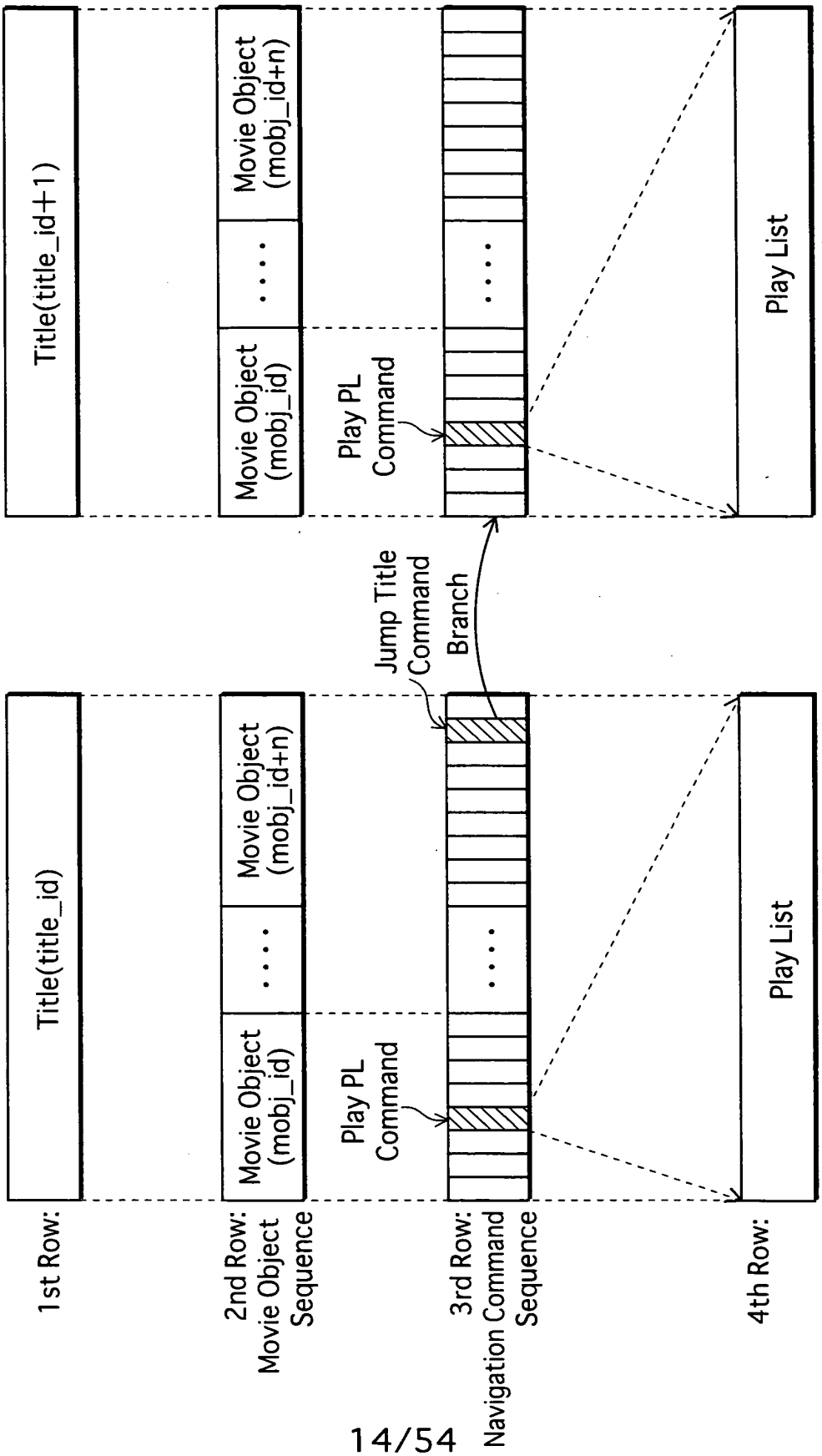

Title(title_id+1)
Movie Object (mobj_id)
....
Movie Object (mobj_id+n)
Play PL Command
Play List
Jump Title Command
Branch
Title(title_id)
Movie Object (mobj_id)
....
Movie Object (mobj_id+n)
Play PL Command
Play List
1st Row:
2nd Row: Movie Object Sequence
3rd Row: Navigation Command Sequence
4th Row:

FIG.15

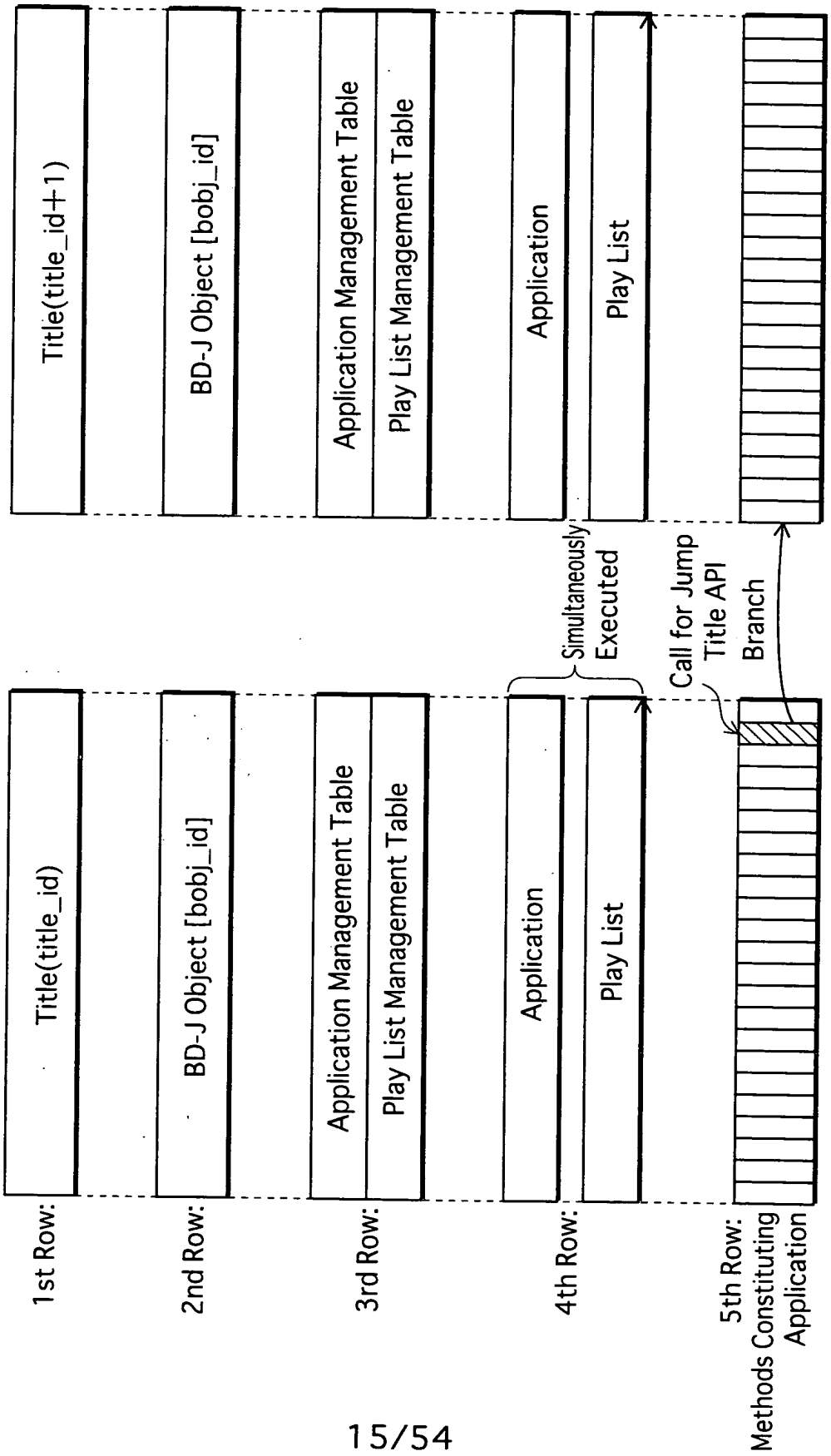

1st Row:
Title(title_id)
Title(title_id+1)
2nd Row:
BD-J Object [bobj_id]
BD-J Object [bobj_id]
3rd Row:
Application Management Table
Play List Management Table
Application Management Table
Play List Management Table
4th Row:
Application
Play List
Application
Play List
Simultaneously Executed
Call for Jump Title API Branch
5th Row:
Methods Constituting Application

FIG.16

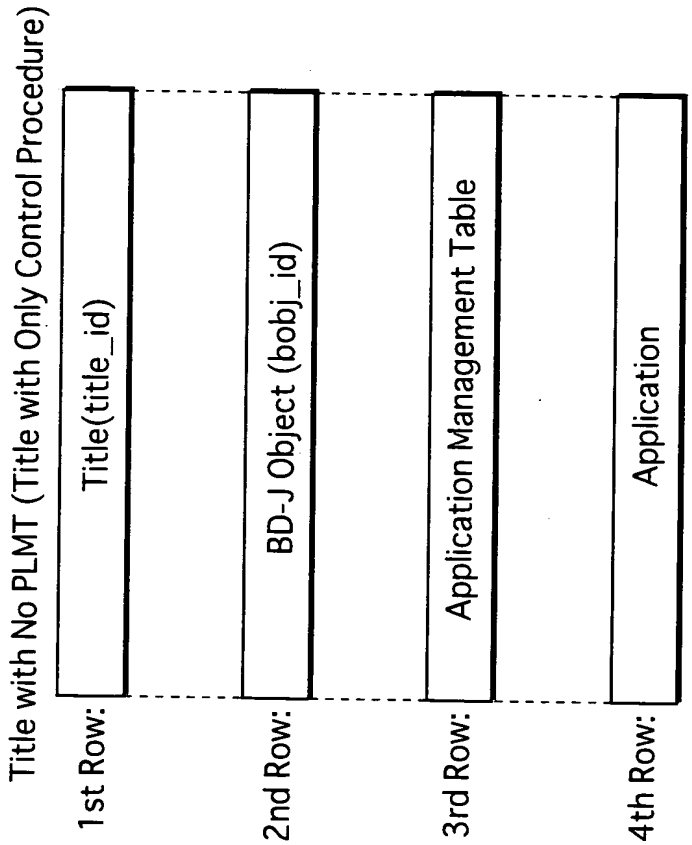

Title with No PLMT (Title with Only Control Procedure)
1st Row:
Title(title_id)
2nd Row:
BD-J Object (bobj_id)
3rd Row:
Application Management Table
4th Row:
Application

FIG.17

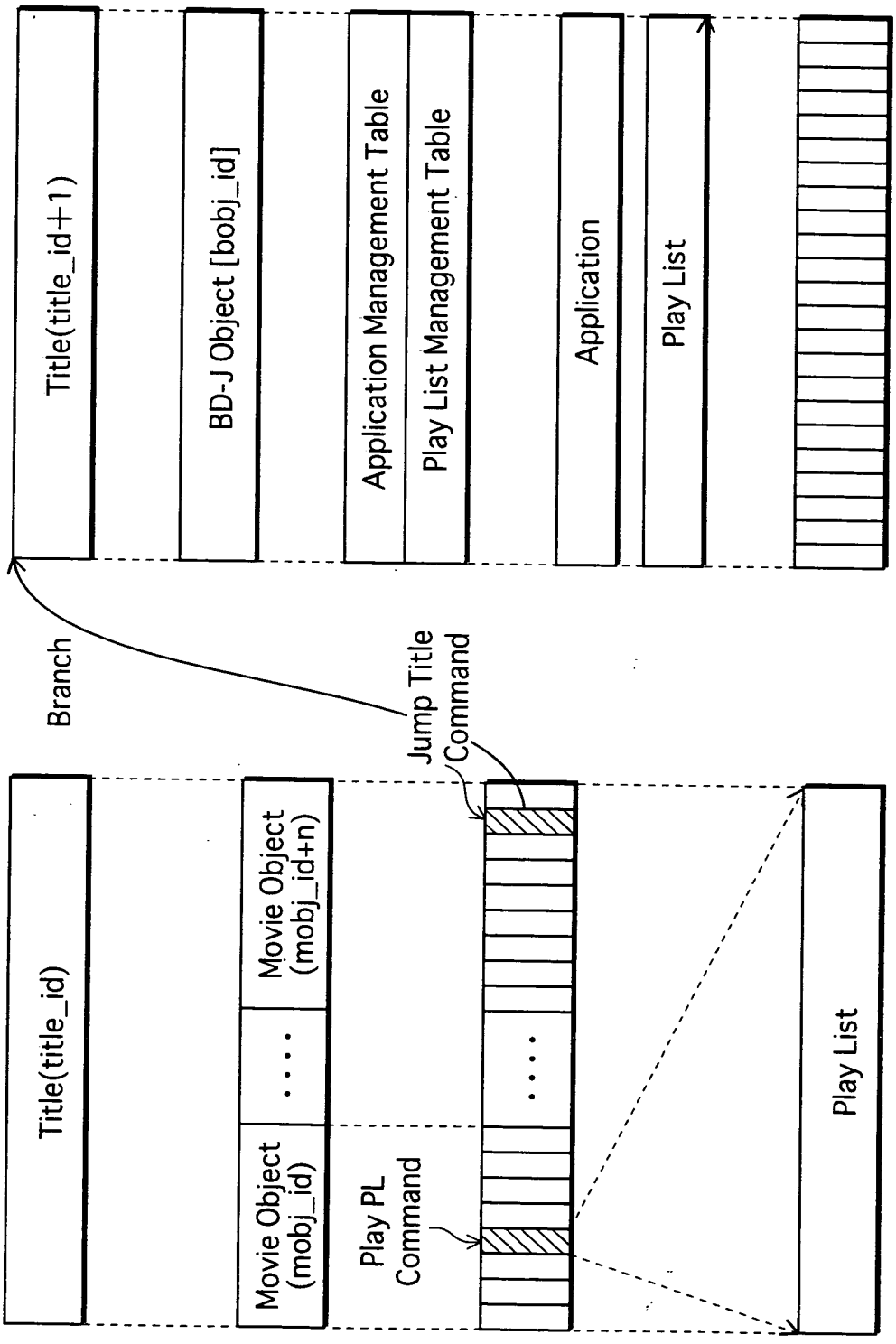

Title(title_id+1)
BD-J Object [bobj_id]
Application Management Table
Play List Management Table
Application
Play List
Branch
Jump Title Command
Title(title_id)
Movie Object (mobj_id)
. . . .
Movie Object (mobj_id+n)
Play PL Command
. . . .
Play List

FIG.18

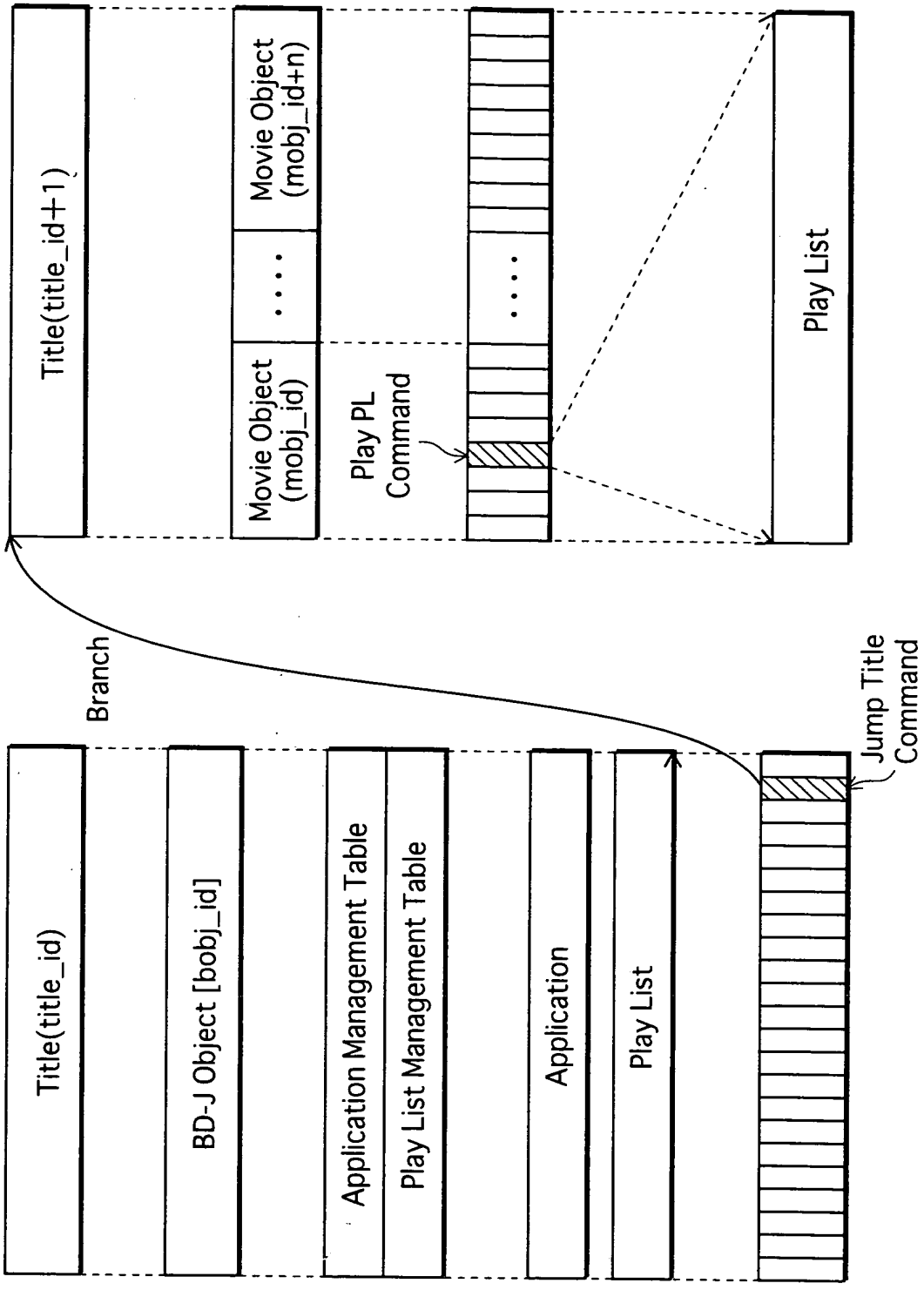

Title(title_id+1)
Movie Object (mobj_id)
....
Movie Object (mobj_id+n)
Play PL Command
....
Play List
Branch
Jump Title Command
Title(title_id)
BD-J Object [bobj_id]
Application Management Table
Play List Management Table
Application
Play List

FIG.19

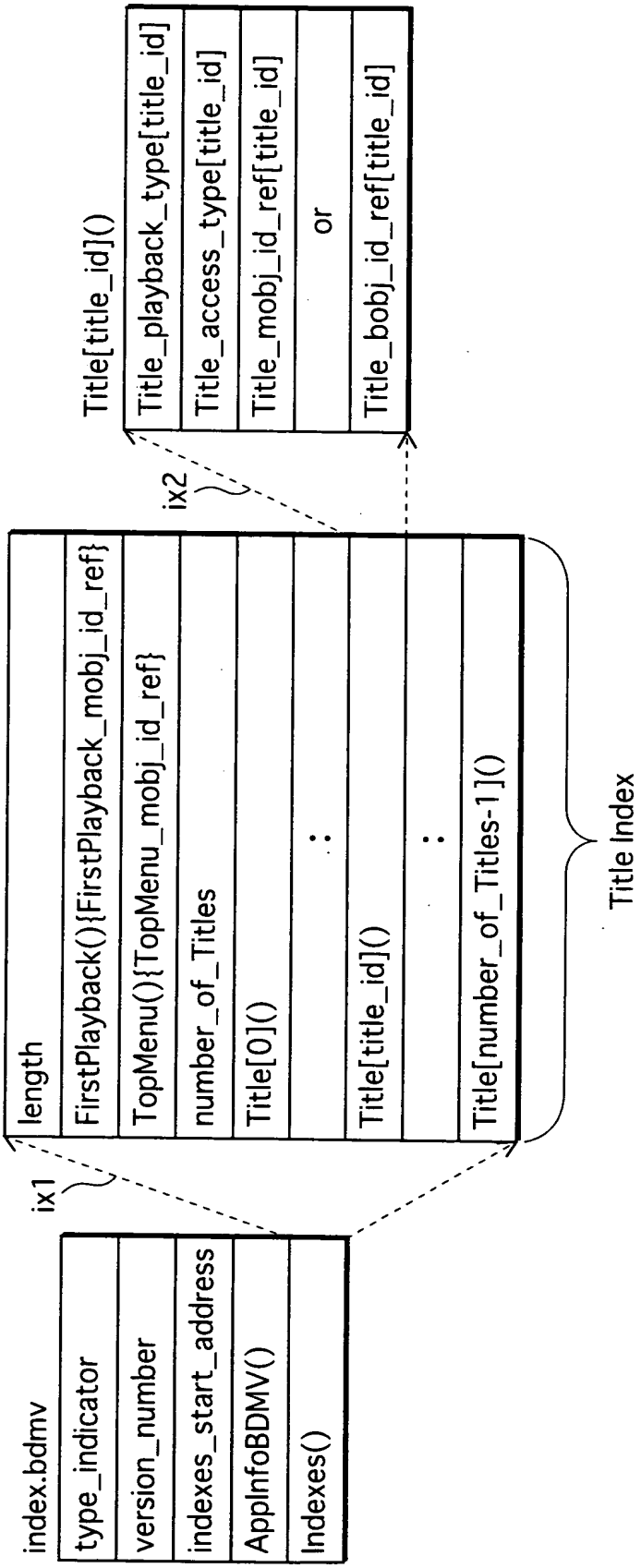

index.bdmv
type_indicator
version_number
indexes_start_address
AppInfoBDMV()
Indexes()
ix1
Indexes()
length
FirstPlayback(){FirstPlayback_mobj_id_ref}
TopMenu(){TopMenu_mobj_id_ref}
number_of_Titles
Title[0]()
:
Title[title_id]()
:
Title[number_of_Titles-1]()
Title Index
ix2
Title[title_id]()
Title_playback_type[title_id]
Title_access_type[title_id]
Title_mobj_id_ref[title_id]
or
Title_bobj_id_ref[title_id]

FIG.20A Application Management Table (AMT)

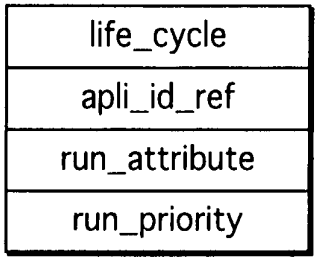


FIG.20B Application Management Table(AMT)

life_cycle	apli_id_ref	run_attribate	run_priority
Application "Life Cycle" Represented by Title, PL, Chapter	Reference Value for "Application ID" Being 5-Digit Integer ZZZZZ Assigned to JAR File Name	"Run Attribute" That Is Auto Run, Present (No Specification), or Suspend	"Run Priority" That Takes Value Ranging from 0 to 255

10/549318

FIG.21A

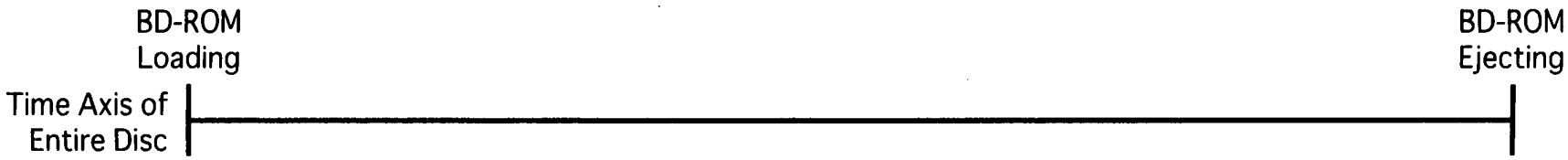
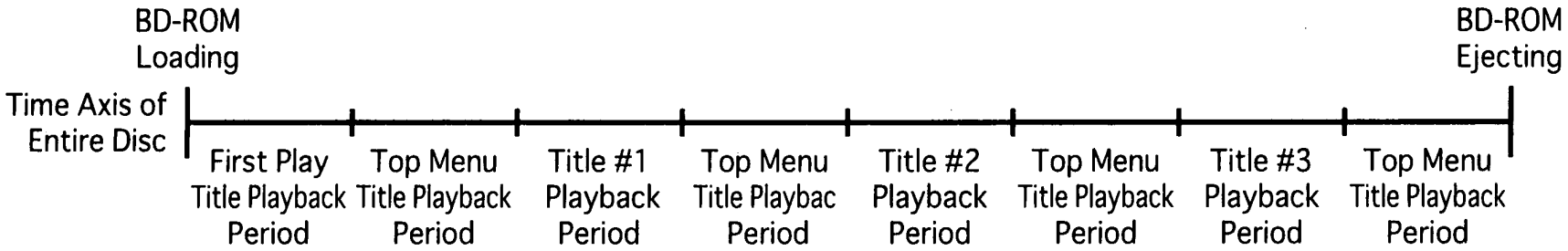


FIG.21B



10/549318

FIG.22A

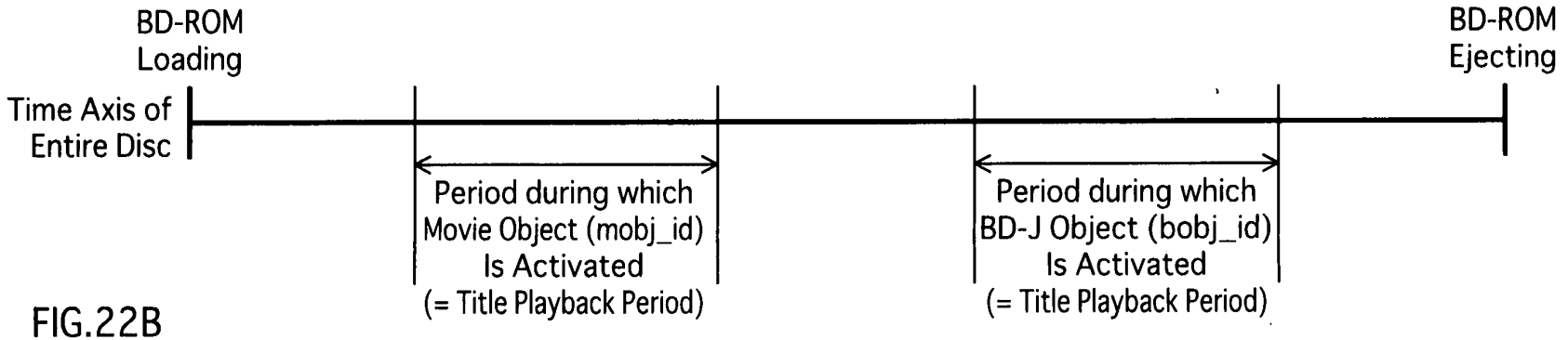
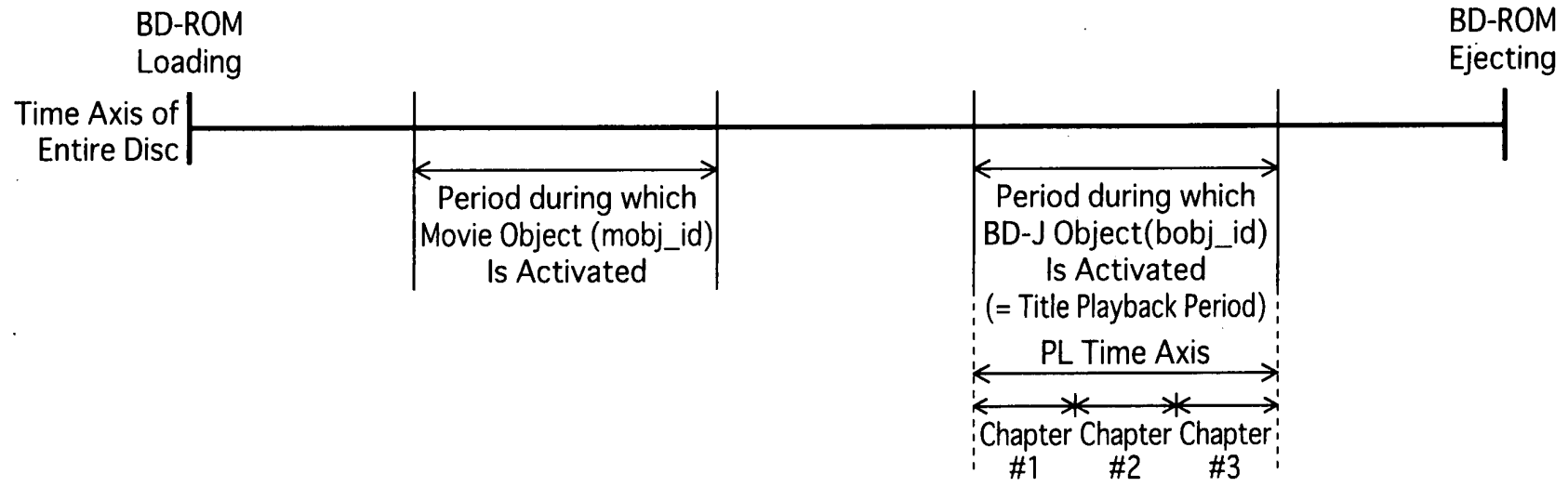


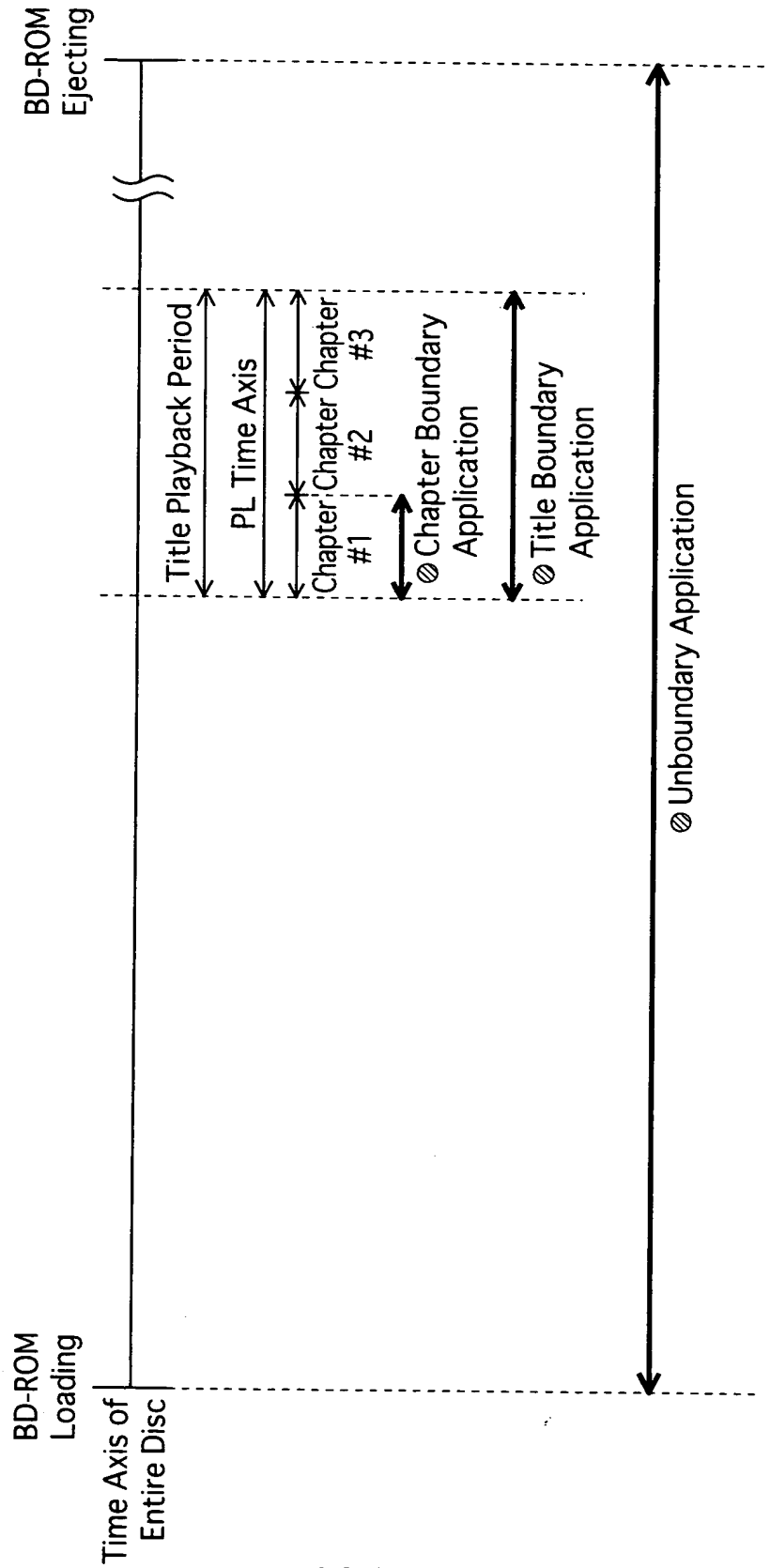
FIG.22B



※If It Contains BD-J Object or PL Playback Procedure,
the PL Time Axis Belongs to Title Playback Period

10/549318

FIG.23


BD-ROM Ejecting
BD-ROM Loading
Time Axis of Entire Disc
Title Playback Period
PL Time Axis
Chapter #1
Chapter #2
Chapter #3
Chapter Boundary Application
Title Boundary Application
Unboundary Application

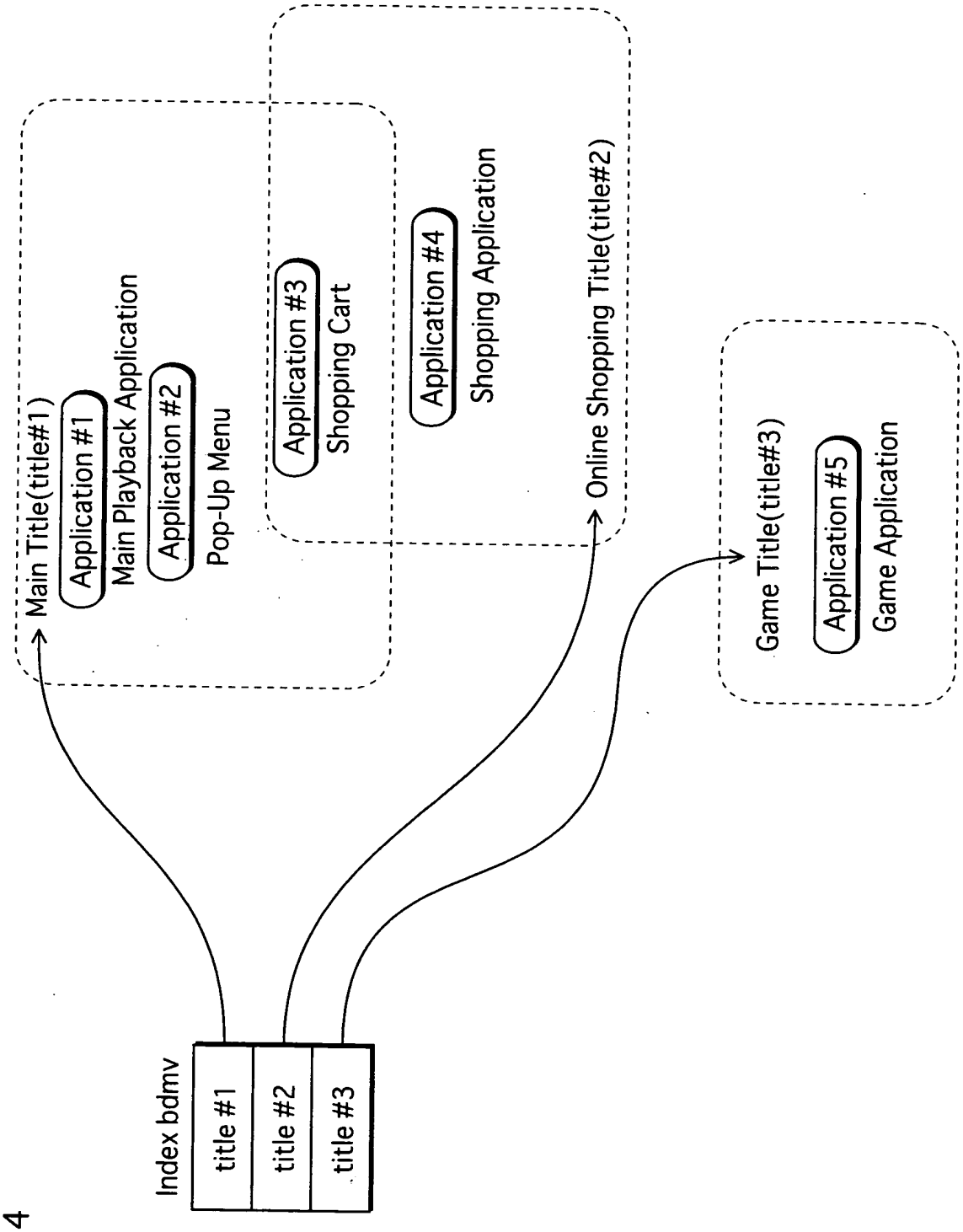

Index bdmv
title #1
title #2
title #3
Main Title(title#1)
Application #1
Main Playback Application
Application #2
Pop-Up Menu
Application #3
Shopping Cart
Application #4
Shopping Application
Online Shopping Title(title#2)
Game Title(title#3)
Application #5
Game Application

FIG.24

FIG.25A

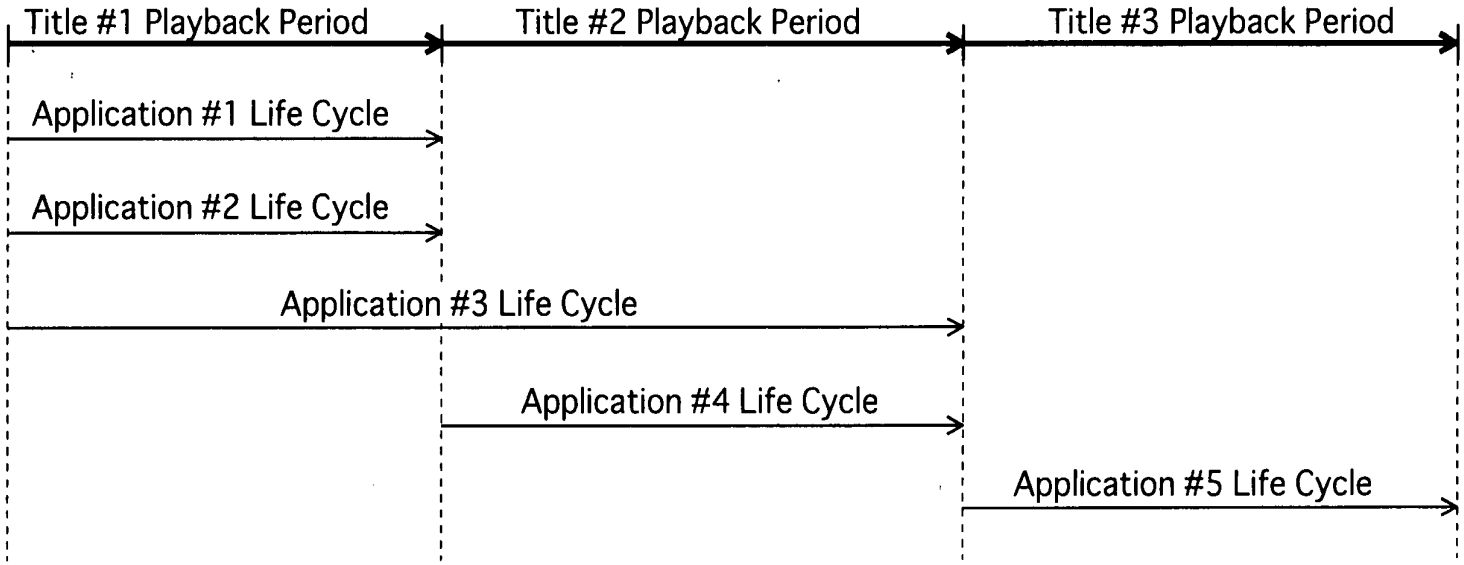


FIG.25B

Application Management Table for Title #1

Life Cycle	Reference Value for Application ID	Run Attribute	Run Priority
title #1	application #1		
title #1	application #2		
title #1	application #3		

Application Management Table for Title #2

Life Cycle	Reference Value for Application ID	Run Attribute	Run Priority
title #2	application #3		
title #2	application #4		

Application Management Table for Title #3

Life Cycle	Reference Value for Application ID	Run Attribute	Run Priority
title #3	application #5		

10/549318

FIG.26

Application Status Change According to Run Attribute

		Run Attribute		
		Present	AutoRun	Suspend
Application Status in Previous Title	Not Run	Maintain Status with No Operation	Start Application	Maintain Status with No Operation
	Running	Maintain Status with No Operation	Maintain Status with No Operation	Suspend
	Suspend	Resume	Resume	Maintain Status with No Operation

10/549318

FIG.27A Play List Management Table (PLMT)

PL_id_ref
Playback_Attribute

FIG.27B Play List Management Table (PLMT)

PL_id_ref	Playback_Attribute
"Play List ID" Being 5-Digit Value in MPLS File Name	"Playback Attribute" That Is Auto Play or Present (No Specification)

10/549318

FIG.28

	Branch Destination Title Has No PLMT	Branch Destination Title Has PLMT	
		Playback Attribute : Auto Play	Playback Attribute : Present
Branch Source Title Being Played Back	Stop Playback	Maintain Status	Maintain Status
Branch Source Title Not Being Played Back	Maintain Status	Start Automatic Playback	Maintain Status

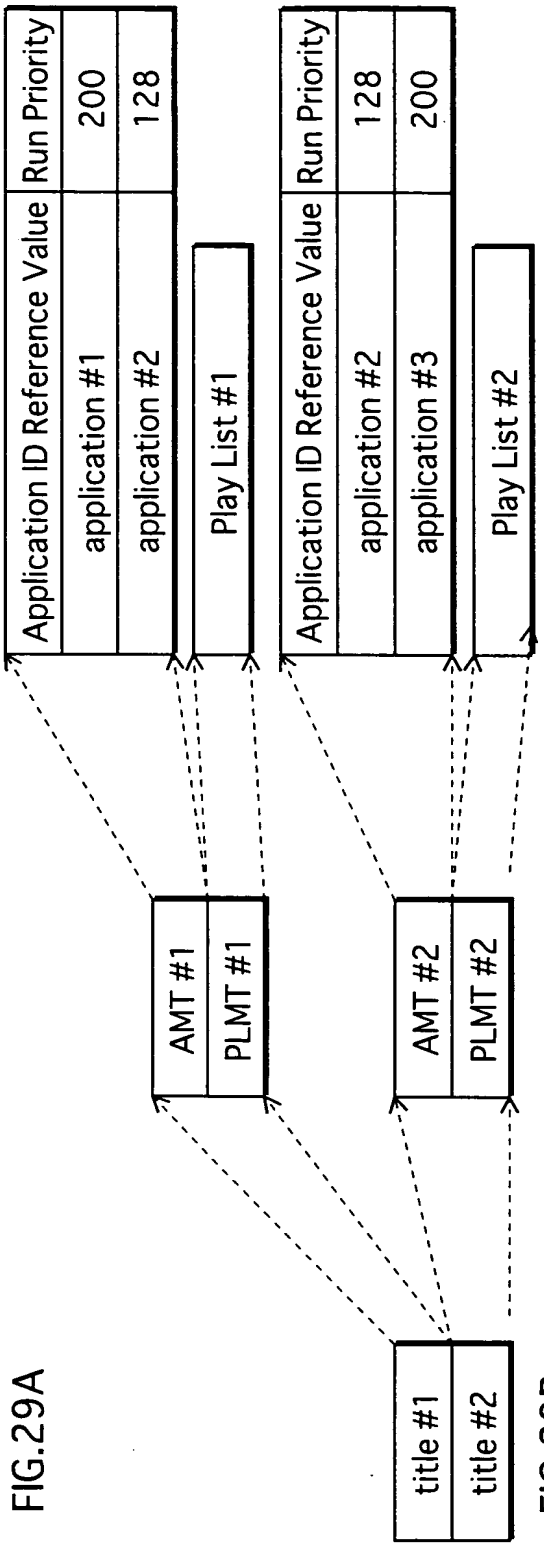


FIG.29A

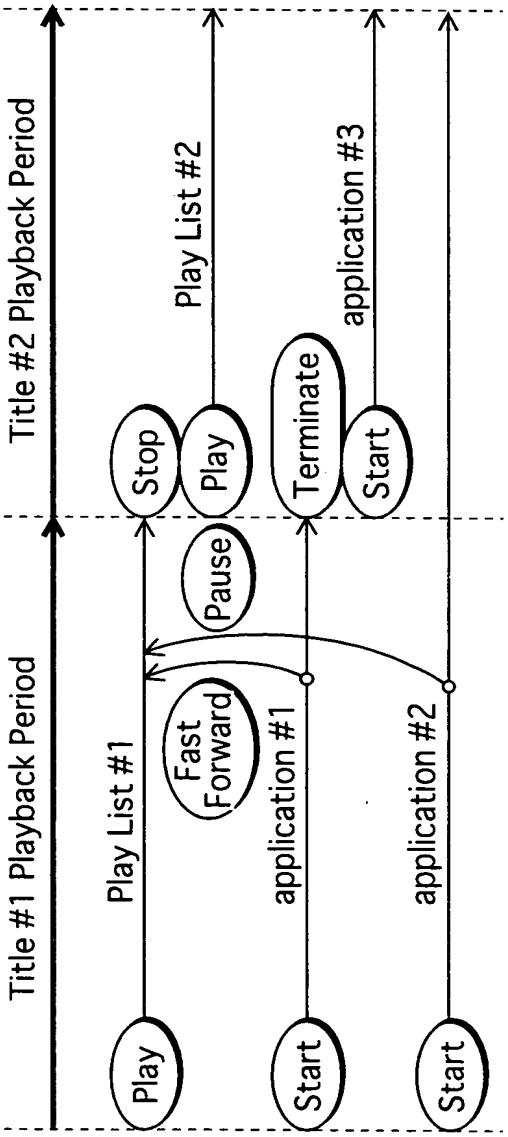


FIG.29B

FIG.30A

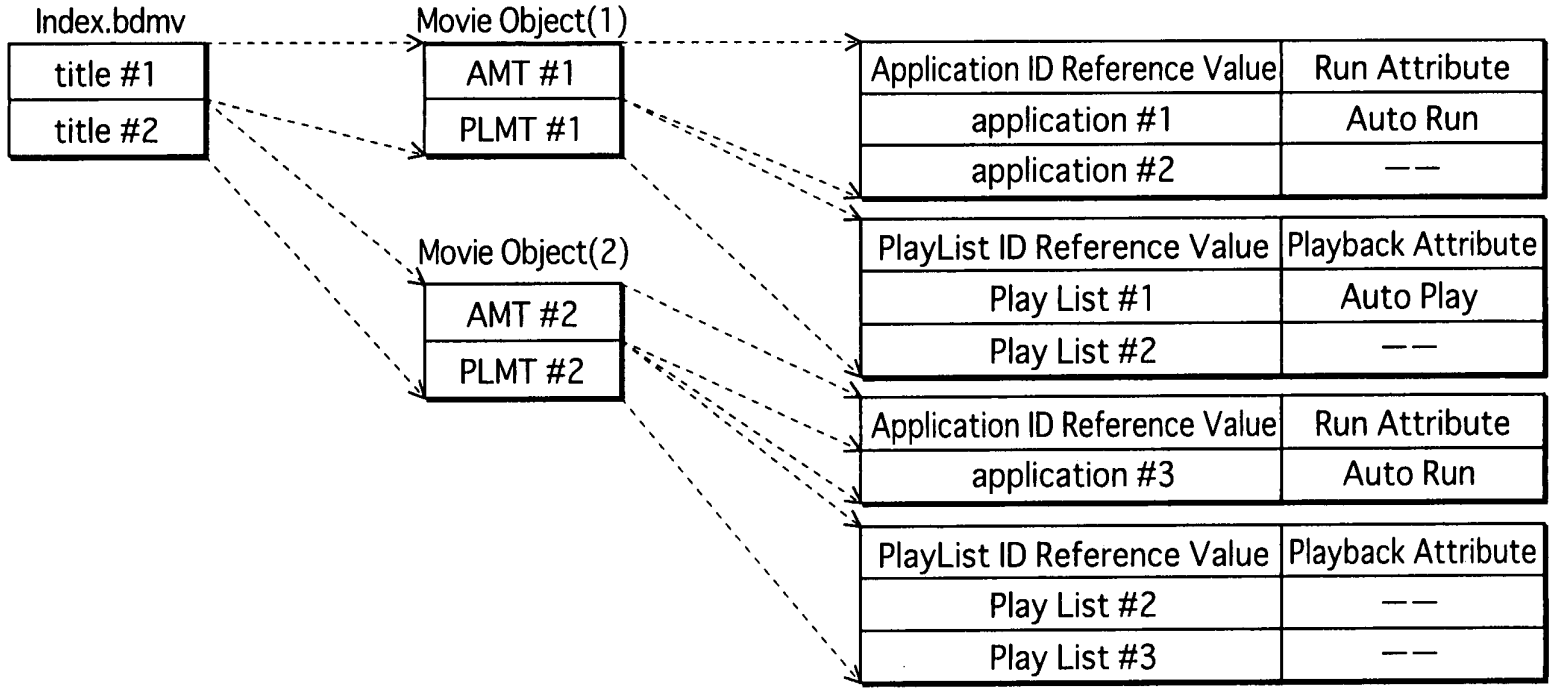
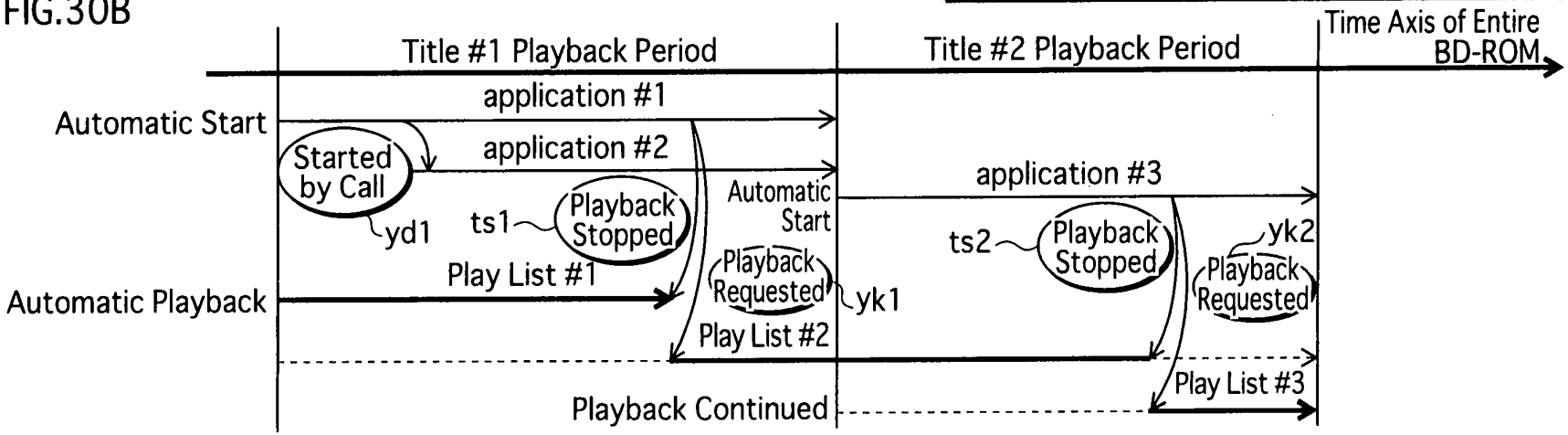


FIG.30B



10/549318

FIG.31A

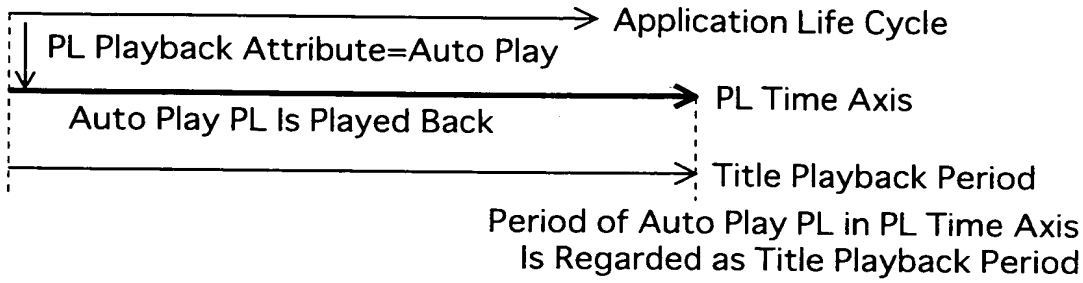


FIG.31B

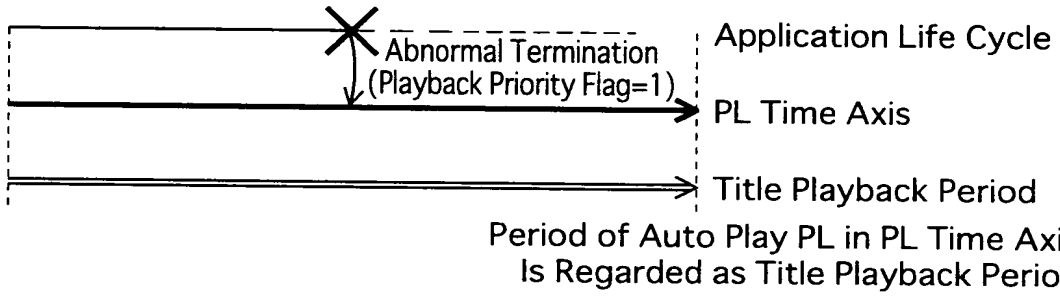


FIG.31C

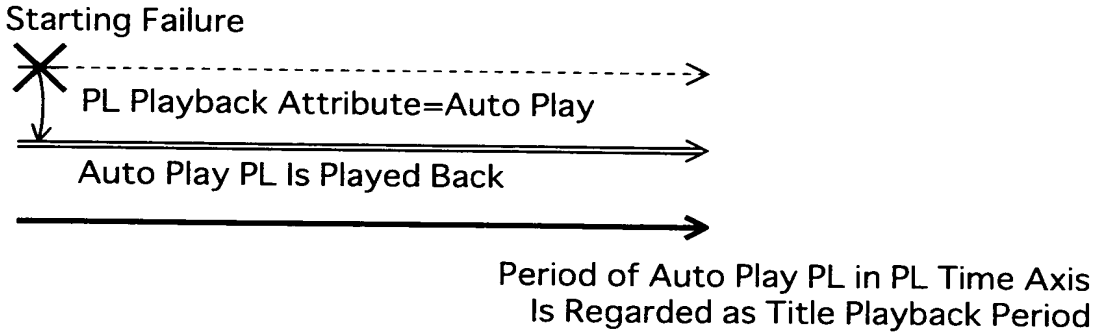
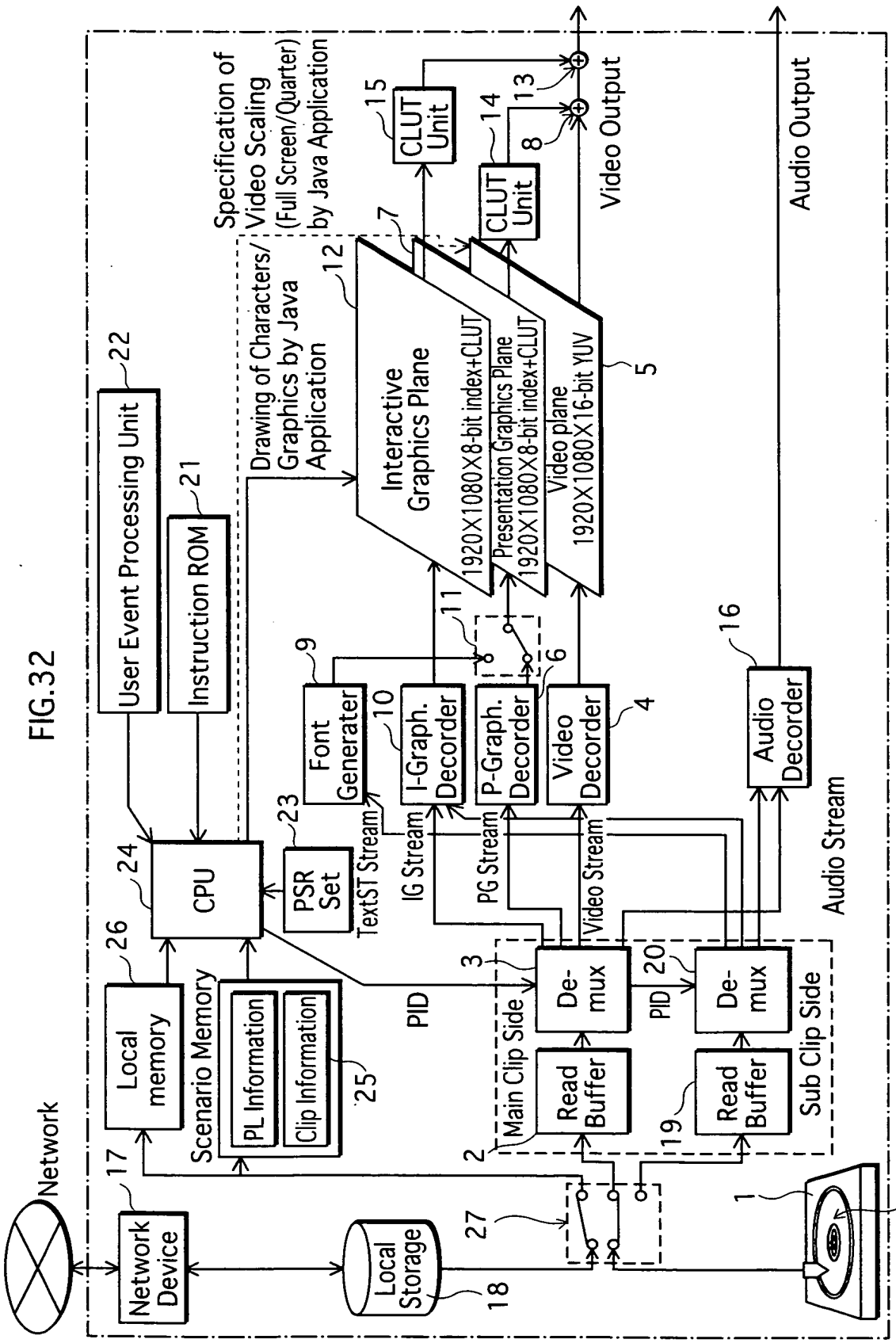


FIG.32


Network
Network Device
17
Local memory
26
Scenario Memory
PL Information
Clip Information
25
Local Storage
18
27
100
1
2
Main Clip Side
Read Buffer
De-mux
3
PID
CPU
24
PSR Set
23
TextST Stream
IG Stream
PG Stream
Video Stream
Audio Stream
Font Generater
9
I-Graph. Decorder
10
P-Graph. Decorder
11
Video Decorder
4
Audio Decorder
16
Sub Clip Side
19
20
PID
User Event Processing Unit
22
Instruction ROM
21
Drawing of Characters/ Graphics by Java Application
Specification of Video Scaling (Full Screen/Quarter) by Java Application
Interactive Graphics Plane
12
7
1920X1080X8-bit index+CLUT
Presentation Graphics Plane
1920X1080X8-bit index+CLUT
Video plane
1920X1080X16-bit YUV
5
CLUT Unit
15
CLUT Unit
14
13
8
6
Video Output
Audio Output

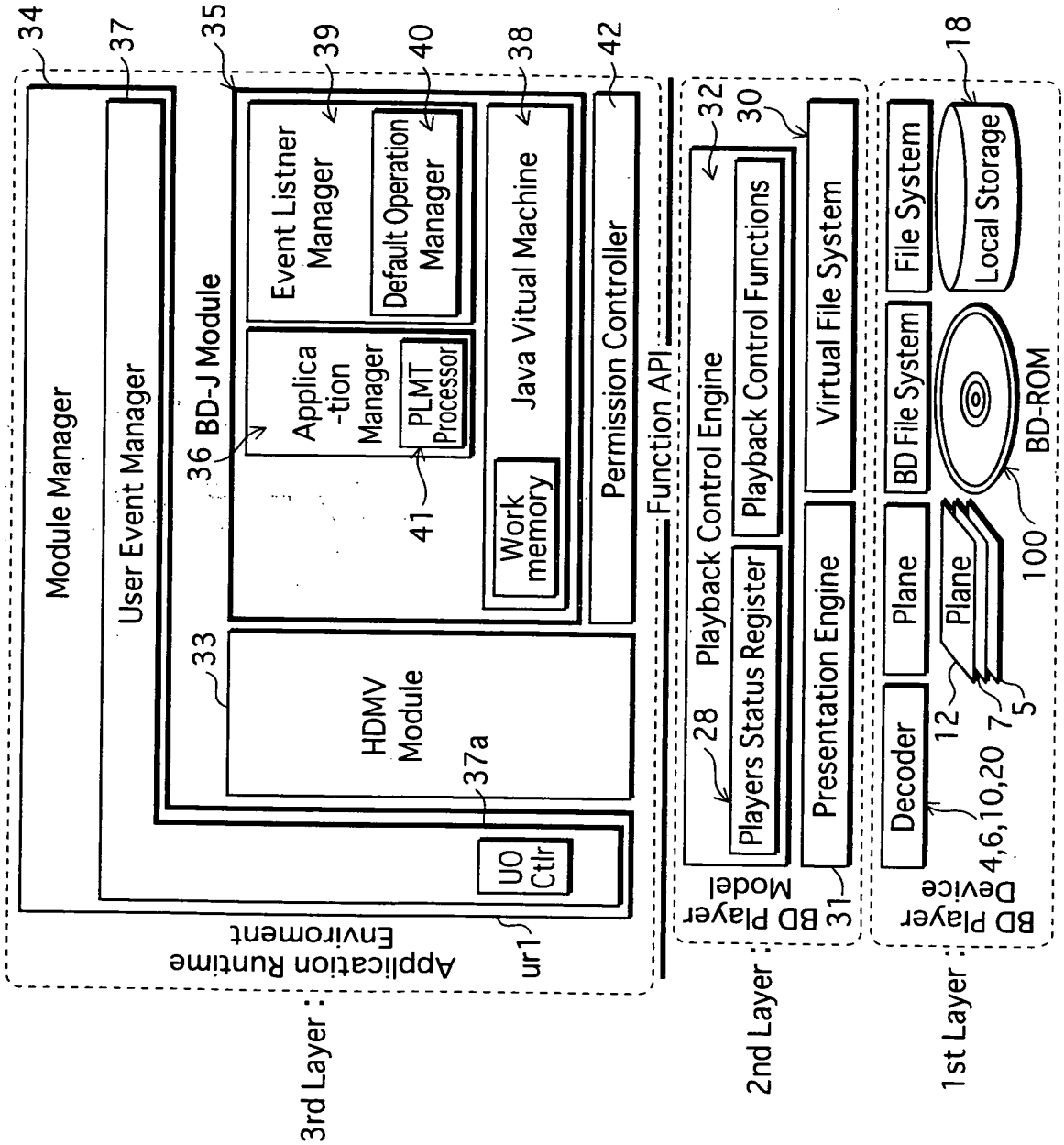

3rd Layer :
2nd Layer :
1st Layer :
Application Runtime Environment
Module Manager
User Event Manager
UO Ctlr
HDMV Module
BD-J Module
Applica -tion Manager
PLMT Processor
Event Listner Manager
Default Operation Manager
Work memory
Java Vitual Machine
Permission Controller
Function API
Playback Control Engine
Players Status Register
Playback Control Functions
Presentation Engine
Virtual File System
BD Player Model
Decoder
Plane
Plane
BD File System
File System
Local Storage
BD-ROM
BD Player Device
ur1
33
36
37a
41
34
37
35
39
40
38
42
28
32
30
31
4,6,10,20
12
7
5
100
18

FIG.33

FIG.34

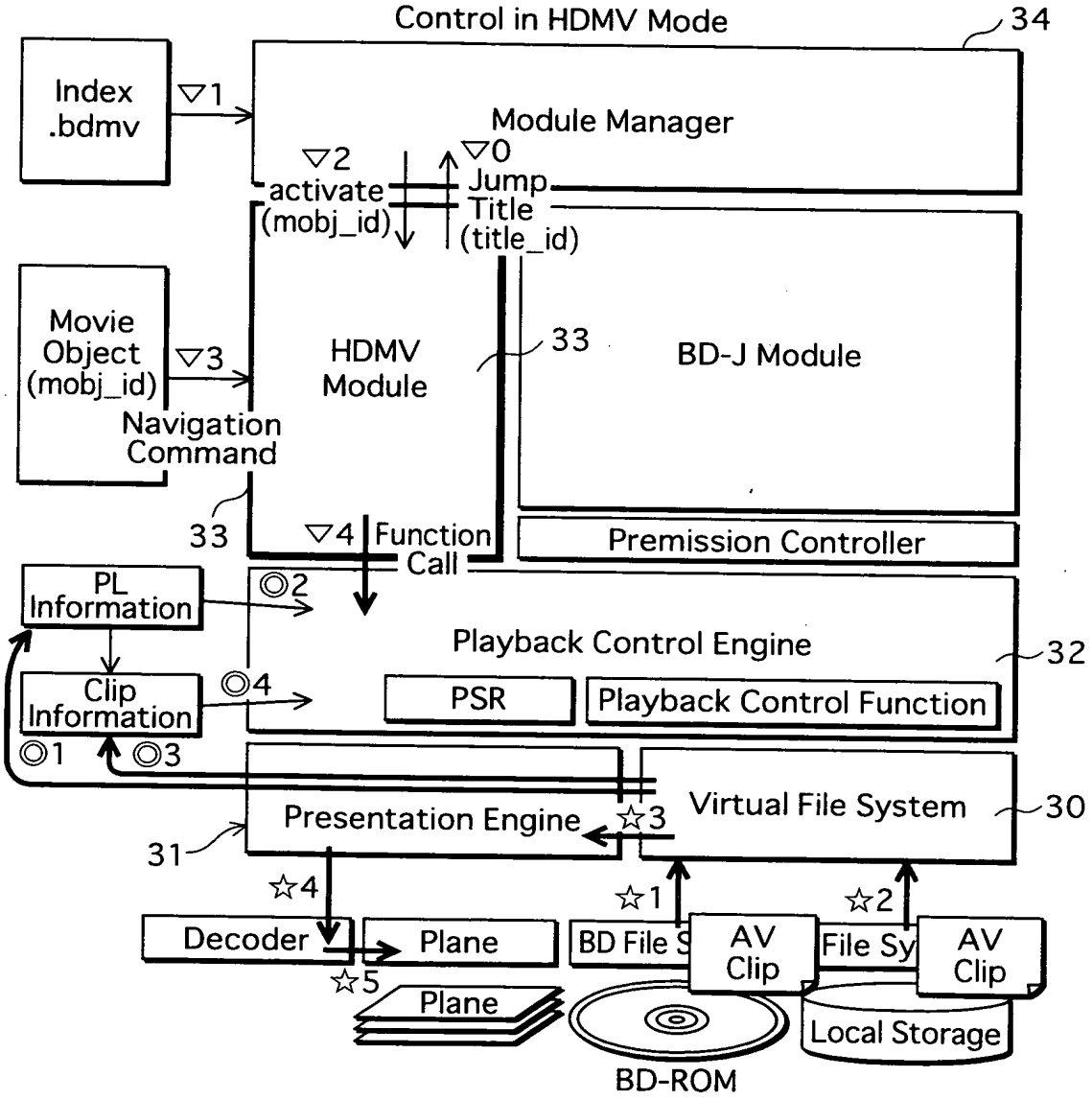
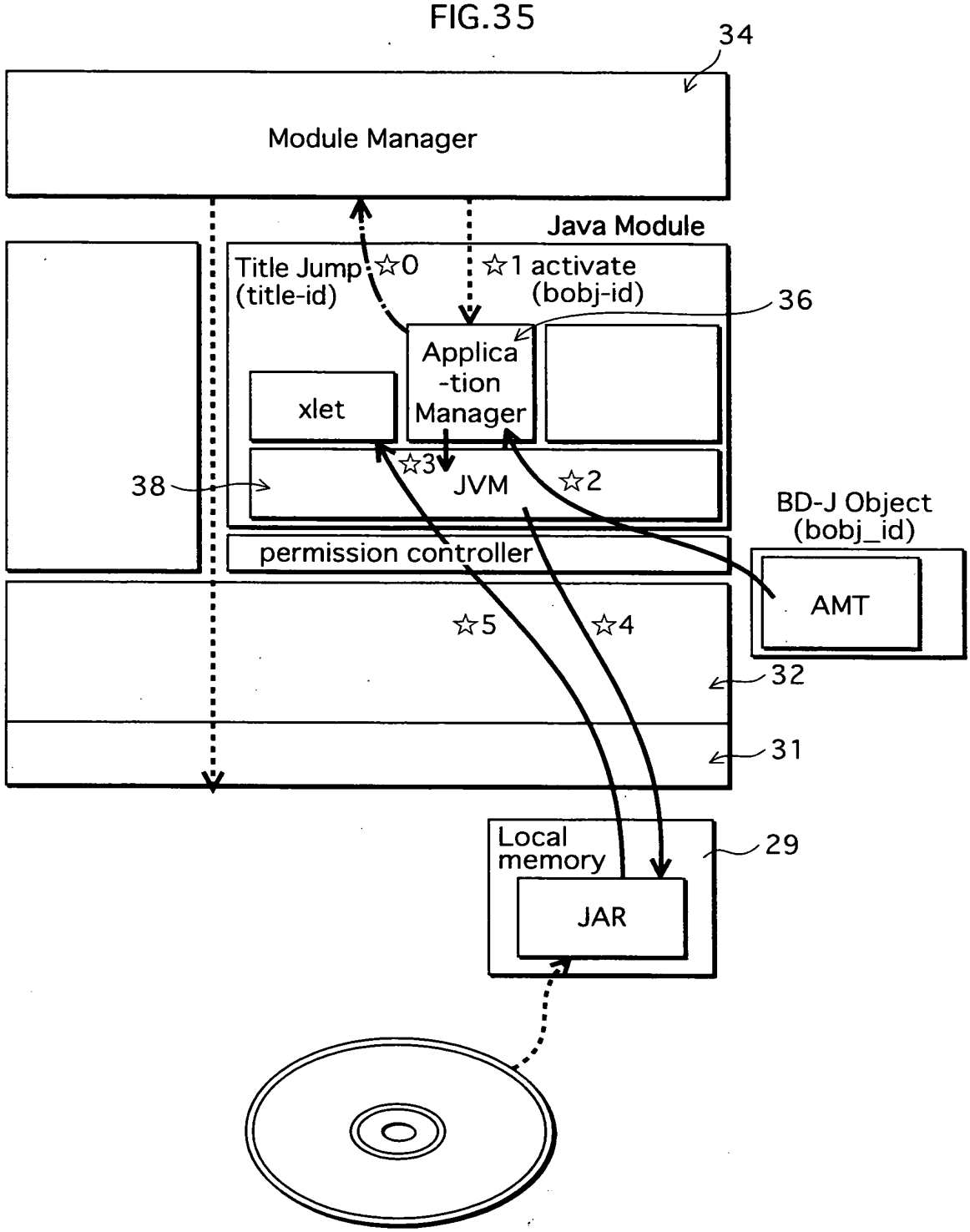

Control in HDMV Mode
34
Index .bdmv
▽1
Module Manager
▽2 activate (mobj_id)
▽0 Jump Title (title_id)
Movie Object (mobj_id)
▽3
HDMV Module
33
BD-J Module
Navigation Command
33
▽4 Function Call
Premission Controller
PL Information
◎2
Playback Control Engine
32
Clip Information
◎4
PSR
Playback Control Function
◎1
◎3
Virtual File System
30
Presentation Engine
☆3
31
☆4
☆1
☆2
Decoder
Plane
BD File S
AV Clip
File Sy
AV Clip
☆5
Plane
Local Storage
BD-ROM

FIG.35



xlet Loading and Activation Control

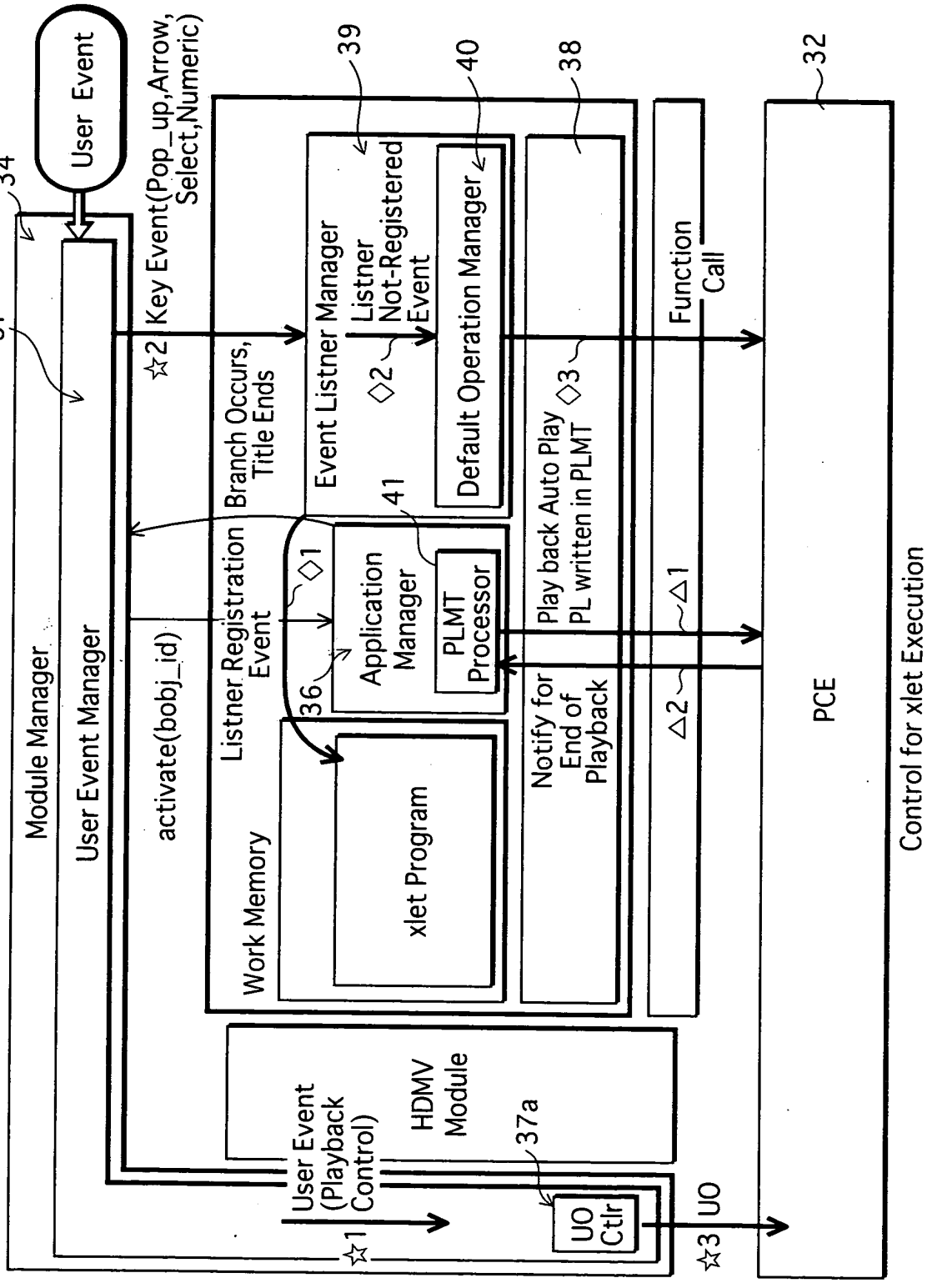

User Event
34
Key Event(Pop_up,Arrow, Select,Numeric)
37
Module Manager
User Event Manager
activate(bobj_id)
☆2
Branch Occurs, Title Ends
Listner Registration Event
◇1
Work Memory
xlet Program
36
Application Manager
41
PLMT Processor
39
Event Listner Manager
Listner Not-Registered Event
◇2
40
Default Operation Manager
38
Play back Auto Play PL written in PLMT
◇3
Notify for End of Playback
Function Call
△1
△2
32
PCE
Control for xlet Execution
User Event (Playback Control)
HDMV Module
37a
UO Ctlr
☆1
UO
☆3

FIG.36

FIG.37

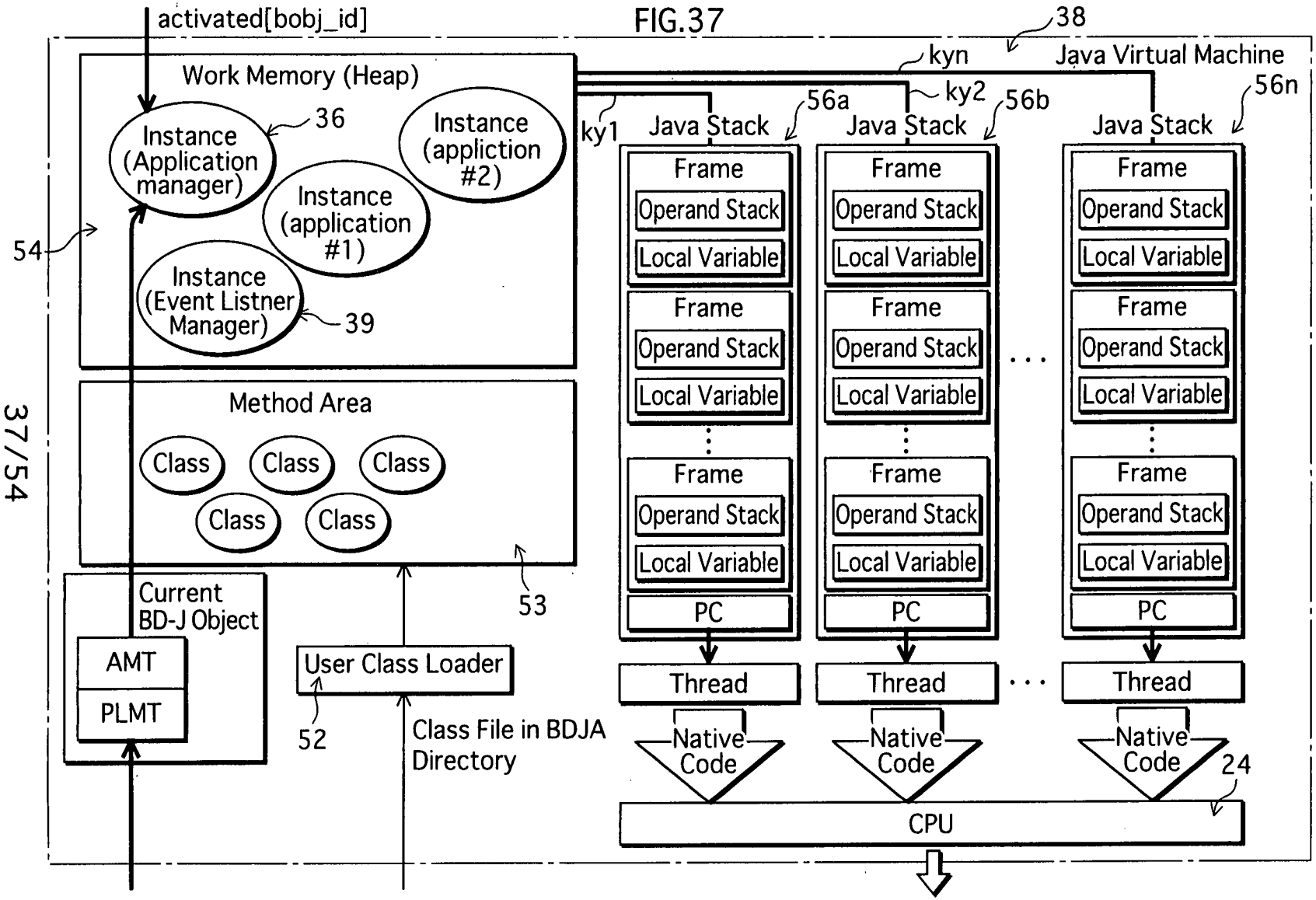
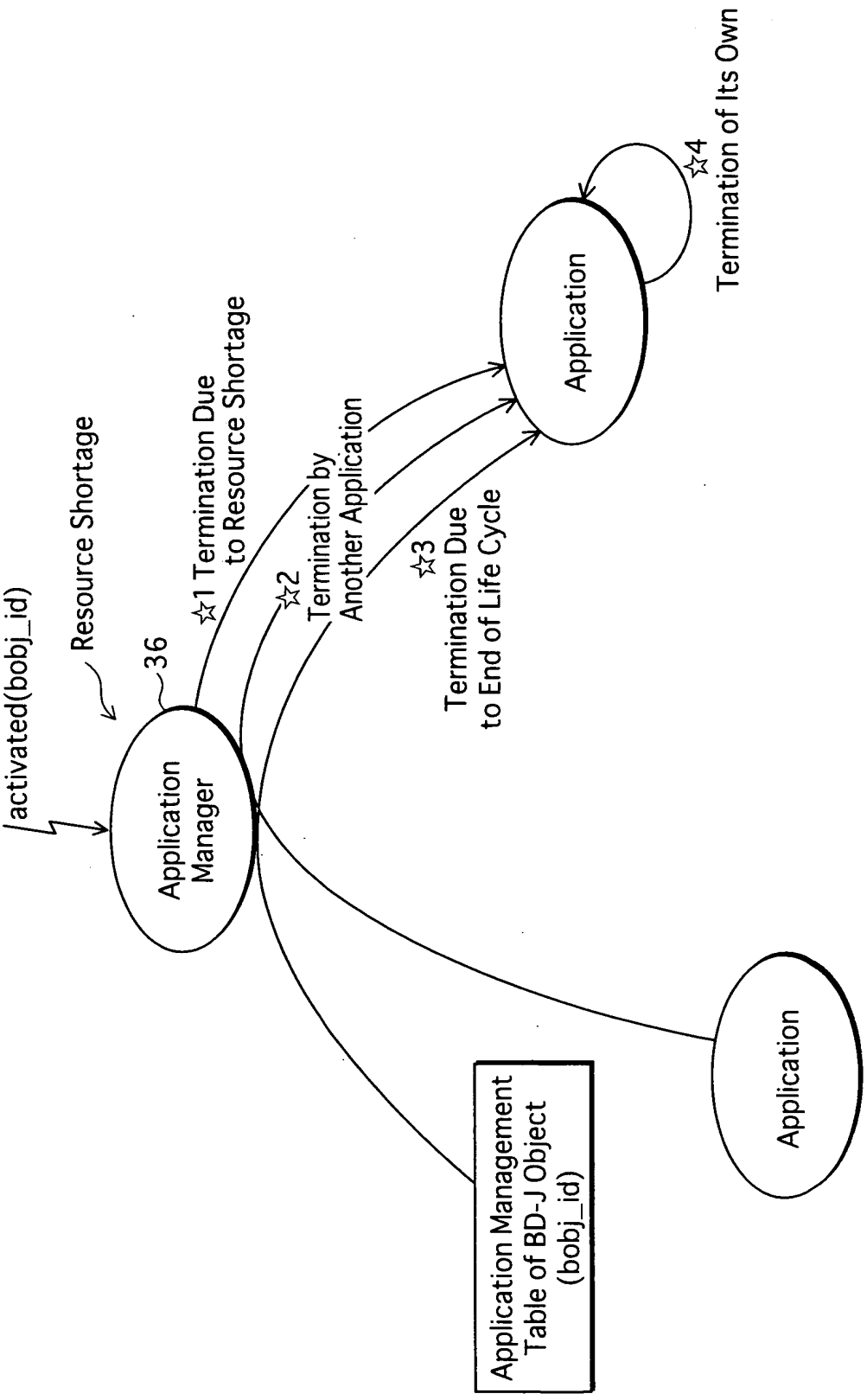

activated[bobj_id]
38
kyn
Java Virtual Machine
Work Memory (Heap)
ky2
56n
ky1
Java Stack
56a
Java Stack
56b
Java Stack
36
Instance (Application manager)
Instance (appliction #2)
Instance (application #1)
54
Instance (Event Listner Manager)
39
Frame
Operand Stack
Local Variable
PC
Method Area
Class
Class
Class
Class
Class
53
Current BD-J Object
AMT
PLMT
User Class Loader
52
Class File in BDJA Directory
Thread
Native Code
24
CPU

FIG.38


activated(bobj_id)
Resource Shortage
Application Manager
36
☆1 Termination Due to Resource Shortage
☆2 Termination by Another Application
☆3 Termination Due to End of Life Cycle
Application
☆4 Termination of Its Own
Application
Application Management Table of BD-J Object (bobj_id)

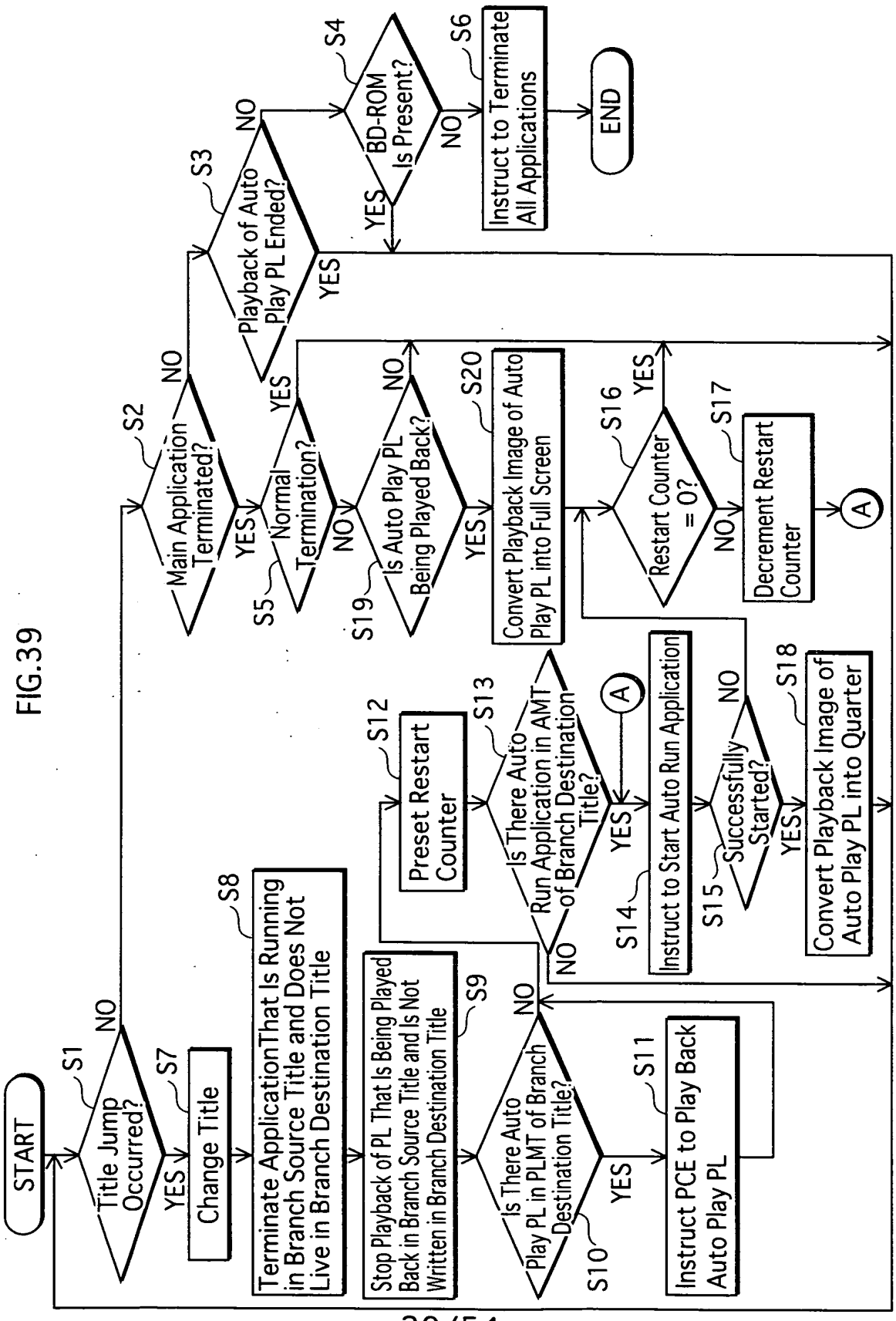

START
S1
Title Jump Occurred?
NO
YES
S7
Change Title
S8
Terminate ApplicationThat Is Running in Branch Source Title and Does Not Live in Branch Destination Title
Stop Playback of PL That Is Being Played Back in Branch Source Title and Is Not Written in Branch Destination Title
S9
Is There Auto Play PL in PLMT of Branch Destination Title?
NO
YES
S10
S11
Instruct PCE to Play Back Auto Play PL
S12
Preset Restart Counter
S13
Is There Auto Run Application in AMT of Branch Destination Title?
NO
YES
A
S14
Instruct to Start Auto Run Application
S15
Successfully Started?
NO
YES
S18
Convert Playback Image of Auto Play PL into Quarter
S16
Restart Counter = 0?
YES
NO
S17
Decrement Restart Counter
A
S19
Is Auto Play PL Being Played Back?
NO
YES
S20
Convert Playback Image of Auto Play PL into Full Screen
S5
Normal Termination?
NO
YES
S2
Main Application Terminated?
NO
YES
S3
Playback of Auto Play PL Ended?
NO
YES
S4
BD-ROM Is Present?
NO
YES
S6
Instruct to Terminate All Applications
END

FIG.39

FIG.40

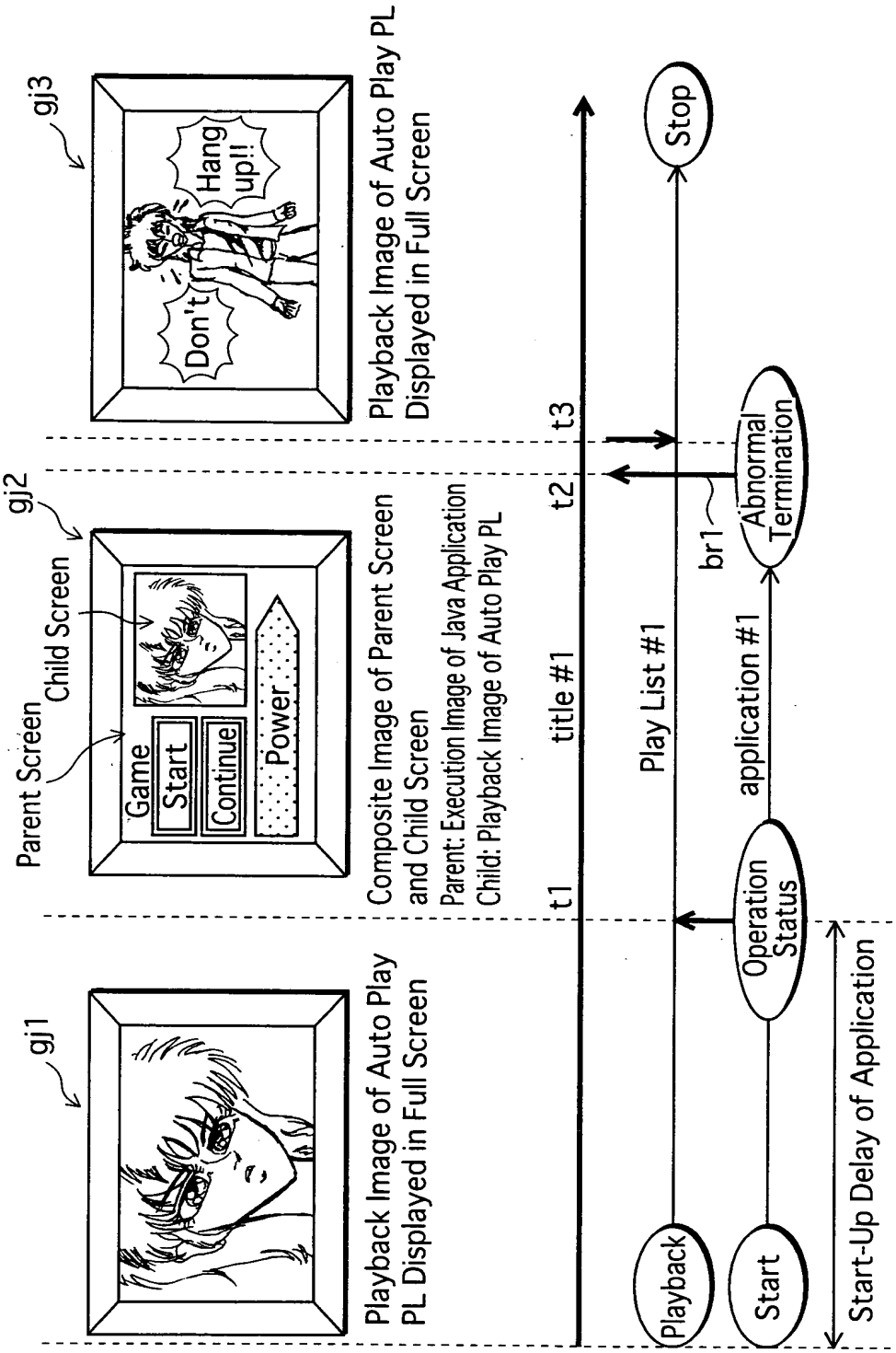

gj1
gj2
gj3
Parent Screen
Child Screen
Game
Start
Continue
Power
Don't
Hang up!!
Playback Image of Auto Play PL Displayed in Full Screen
Composite Image of Parent Screen and Child Screen
Parent: Execution Image of Java Application
Child: Playback Image of Auto Play PL
Playback Image of Auto Play PL Displayed in Full Screen
1st Row :
2nd Row :
3rd Row :
4th Row :
t1
t2
t3
title #1
Play List #1
application #1
br1
Abnormal Termination
Stop
Operation Status
Playback
Start
Start-Up Delay of Application

FIG.41A

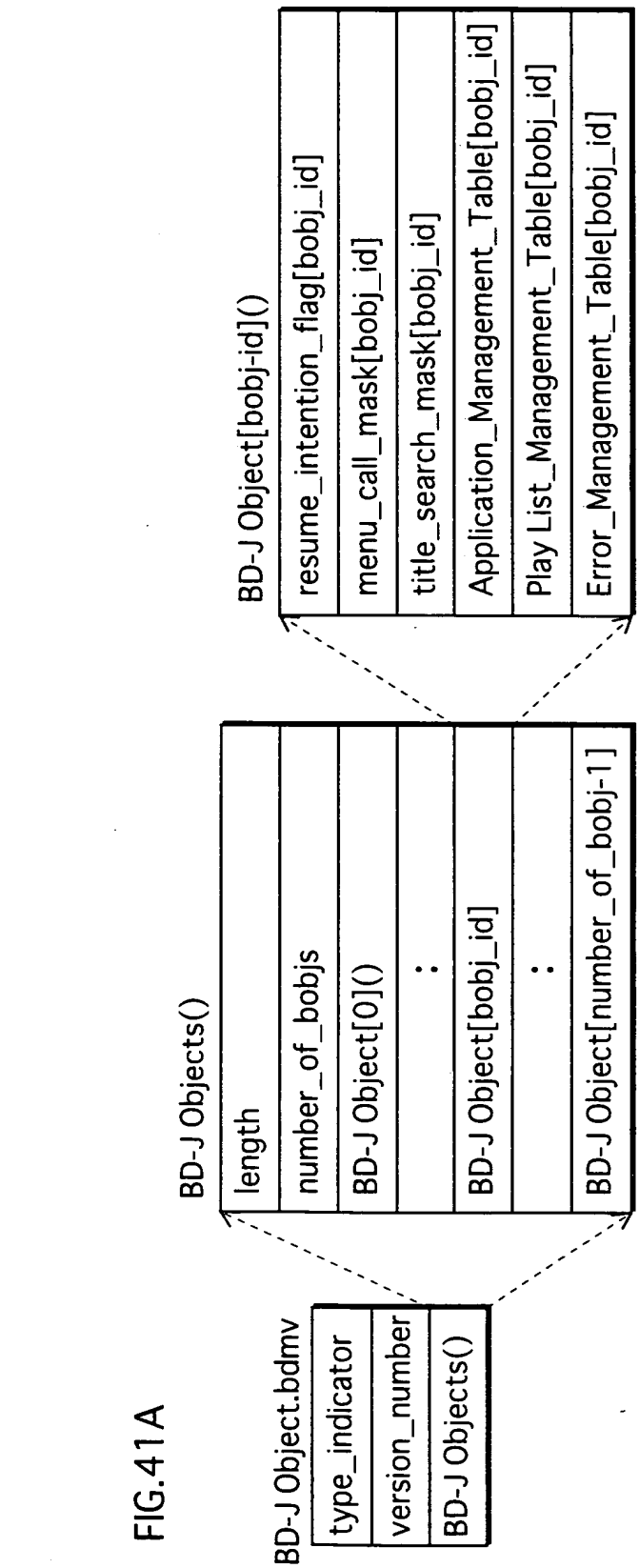


FIG.41B

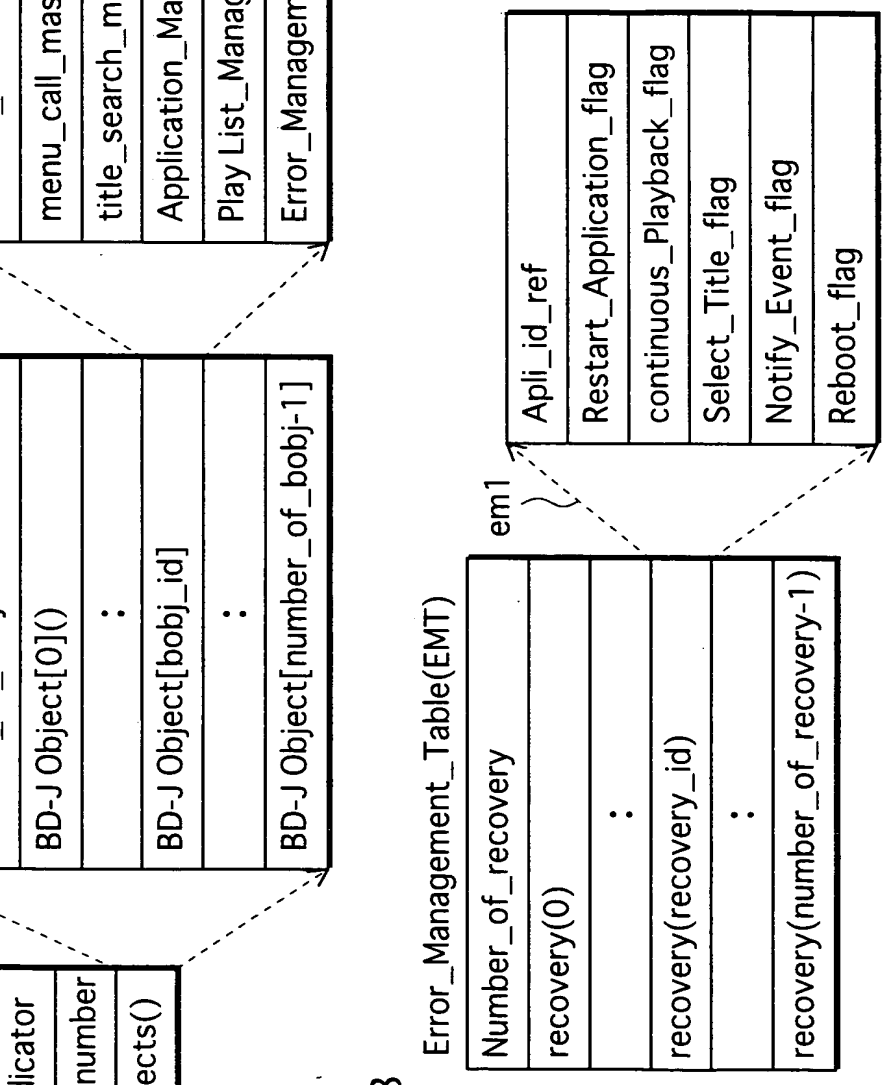


FIG.42

Recovery()

	Value	Default
Restart_Application_Flag (Restart Application)	0 : No n : Number of Restarts	0
Continuous_Playback_Flag (Continuous Playback of PlayList)	0 : No 1 : Yes 2 : Full Screen/Normal Speed Playback	0
Select_Title_Flag (Select Title)	0 : No n : Title Number	0
Notify_Event_Flag (Notify Event)	0 : No n : Event Number	1
Reboot_Flag (Reboot System)	0 : No 1 : Yes	0

10/549318

FIG.43A

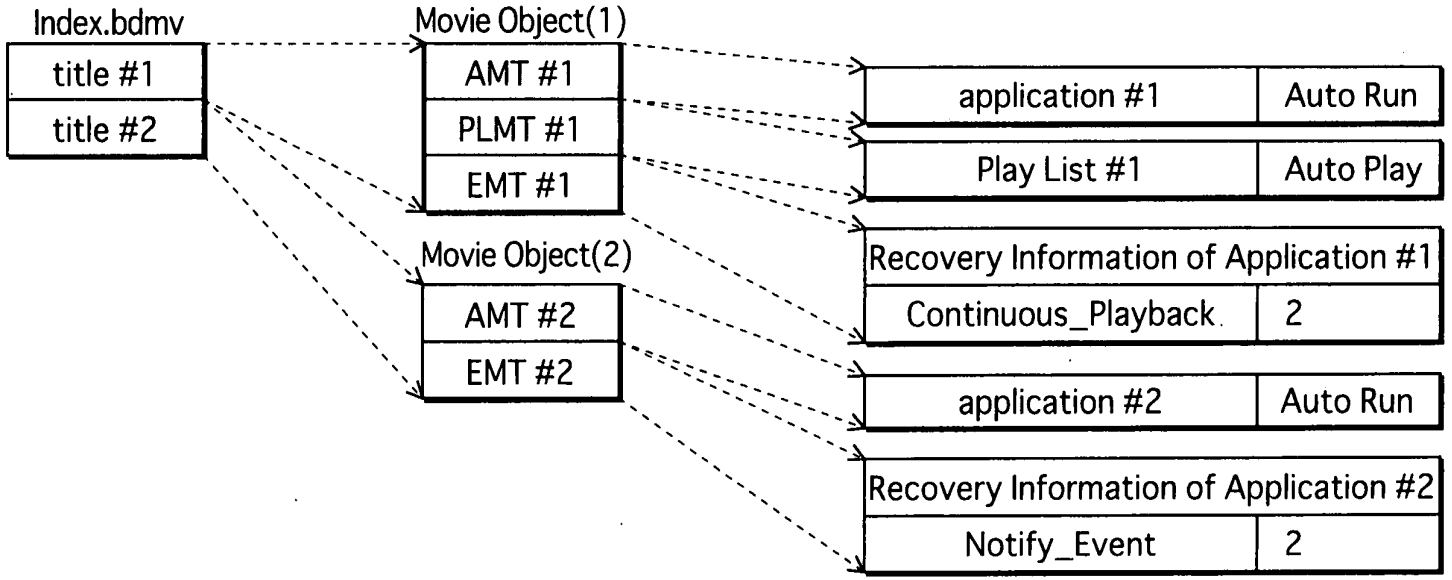
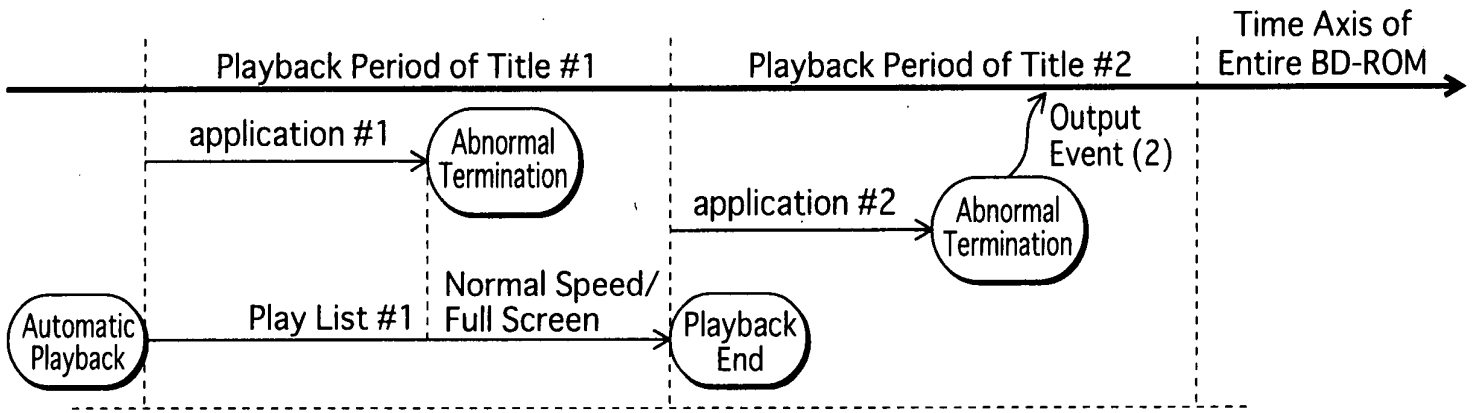


FIG.43B



10/549318

FIG.44

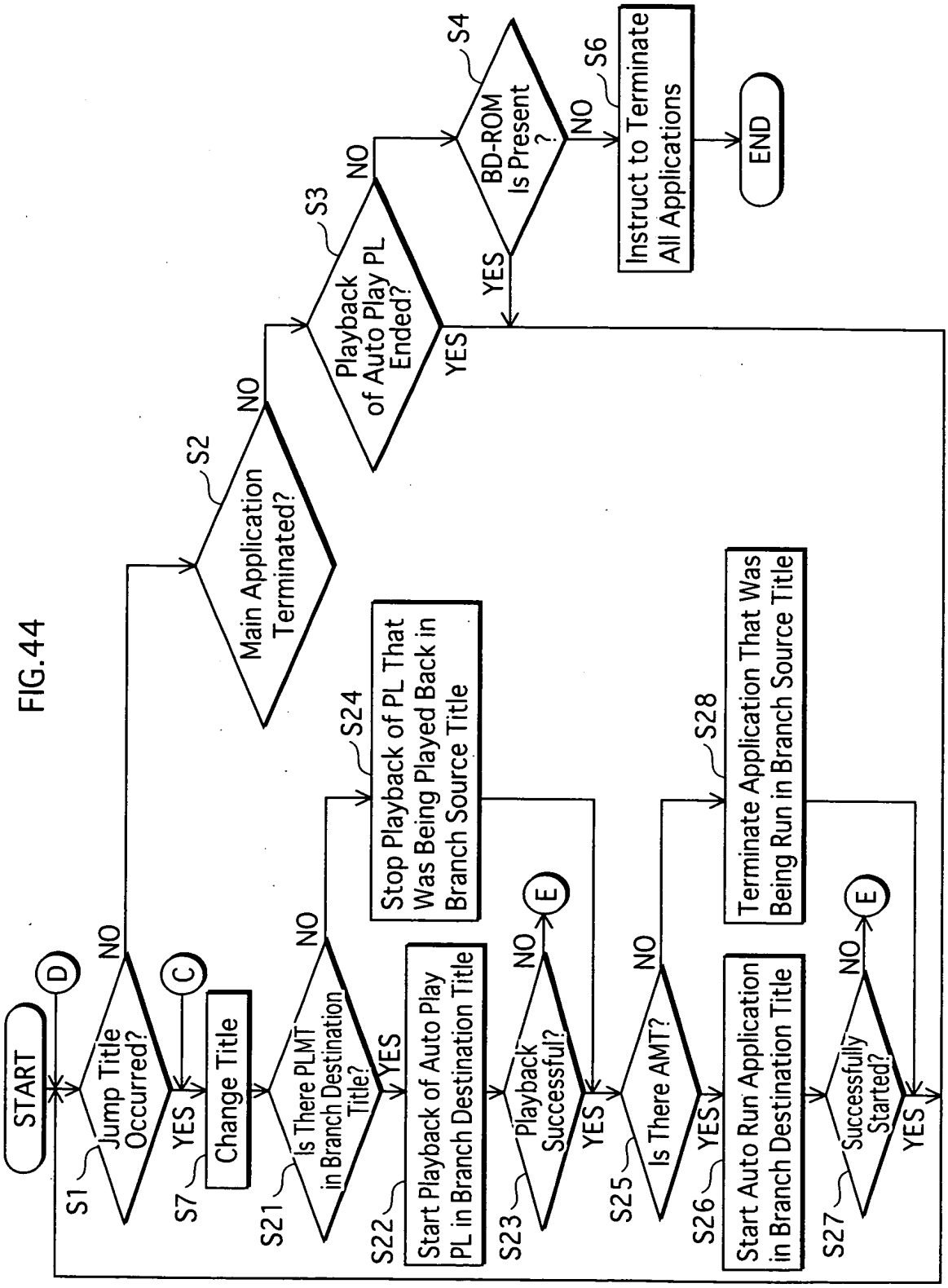

START
D
Jump Title Occurred?
S1
NO
YES
C
Change Title
S7
Main Application Terminated?
S2
NO
Playback of Auto Play PL Ended?
S3
NO
YES
BD-ROM Is Present ?
S4
NO
YES
Instruct to Terminate All Applications
S6
END
Is There PLMT in Branch Destination Title?
S21
NO
YES
Stop Playback of PL That Was Being Played Back in Branch Source Title
S24
Start Playback of Auto Play PL in Branch Destination Title
S22
Playback Successful?
S23
NO
YES
E
Is There AMT?
S25
NO
YES
Terminate Application That Was Being Run in Branch Source Title
S28
Start Auto Run Application in Branch Destination Title
S26
Successfully Started?
S27
NO
YES
E

FIG.45

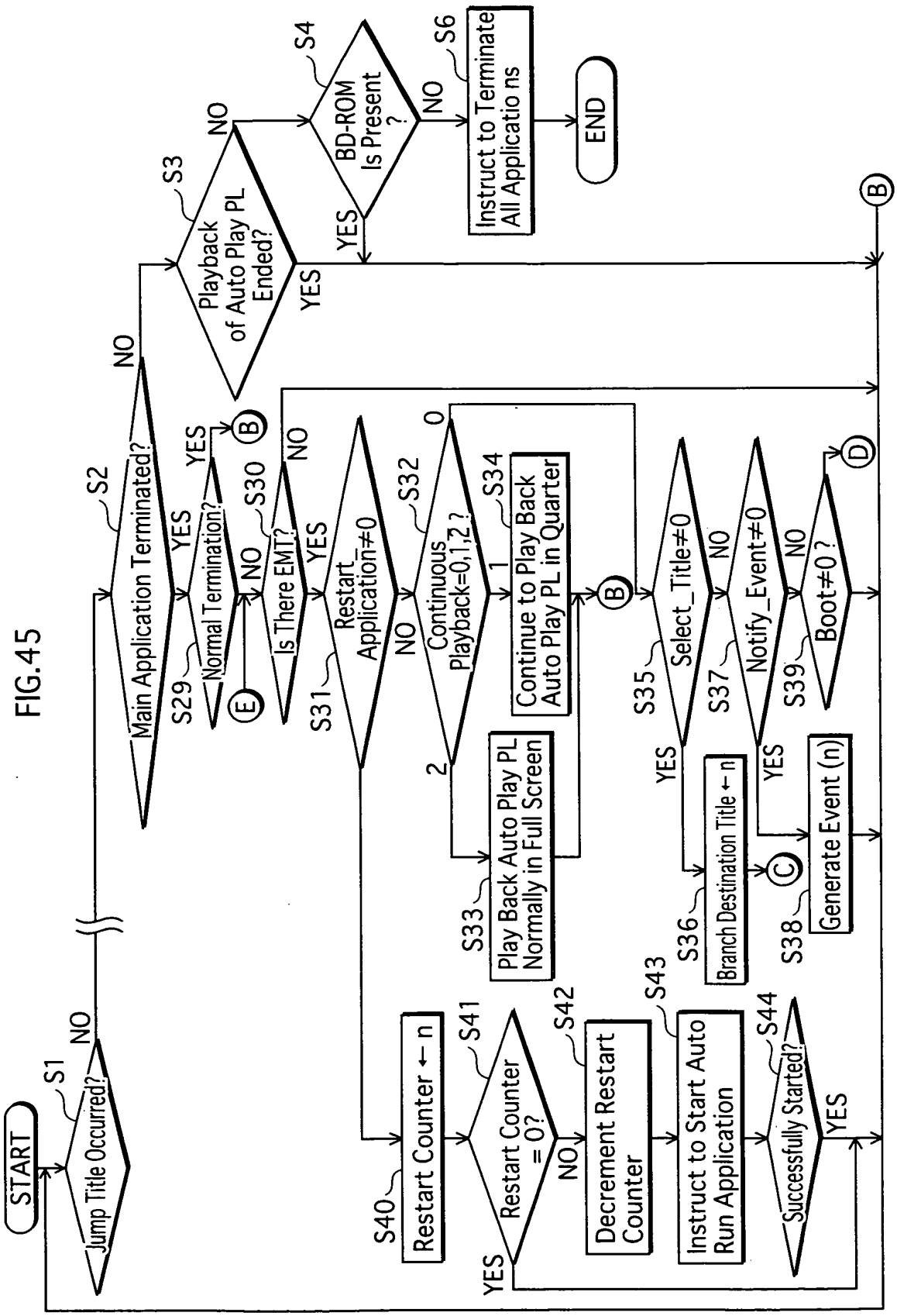

START
S1
Jump Title Occurred?
NO
YES
S2
Main Application Terminated?
NO
YES
S3
Playback of Auto Play PL Ended?
NO
YES
S4
BD-ROM Is Present ?
NO
YES
S6
Instruct to Terminate All Applicatio ns
END
B
S29
Normal Termination?
YES
NO
E
S30
Is There EMT?
YES
NO
S31
Restart Application≠0
YES
NO
S32
Continuous Playback=0,1,2 ?
0
1
2
S34
Continue to Play Back Auto Play PL in Quarter
S33
Play Back Auto Play PL Normally in Full Screen
S35
Select_Title≠0
YES
NO
S36
Branch Destination Title ← n
C
S37
Notify_Event≠0
YES
NO
S38
Generate Event (n)
S39
Boot≠0 ?
YES
NO
D
S40
Restart Counter ← n
S41
Restart Counter = 0?
YES
NO
S42
Decrement Restart Counter
S43
Instruct to Start Auto Run Application
S44
Successfully Started?
YES

FIG.46

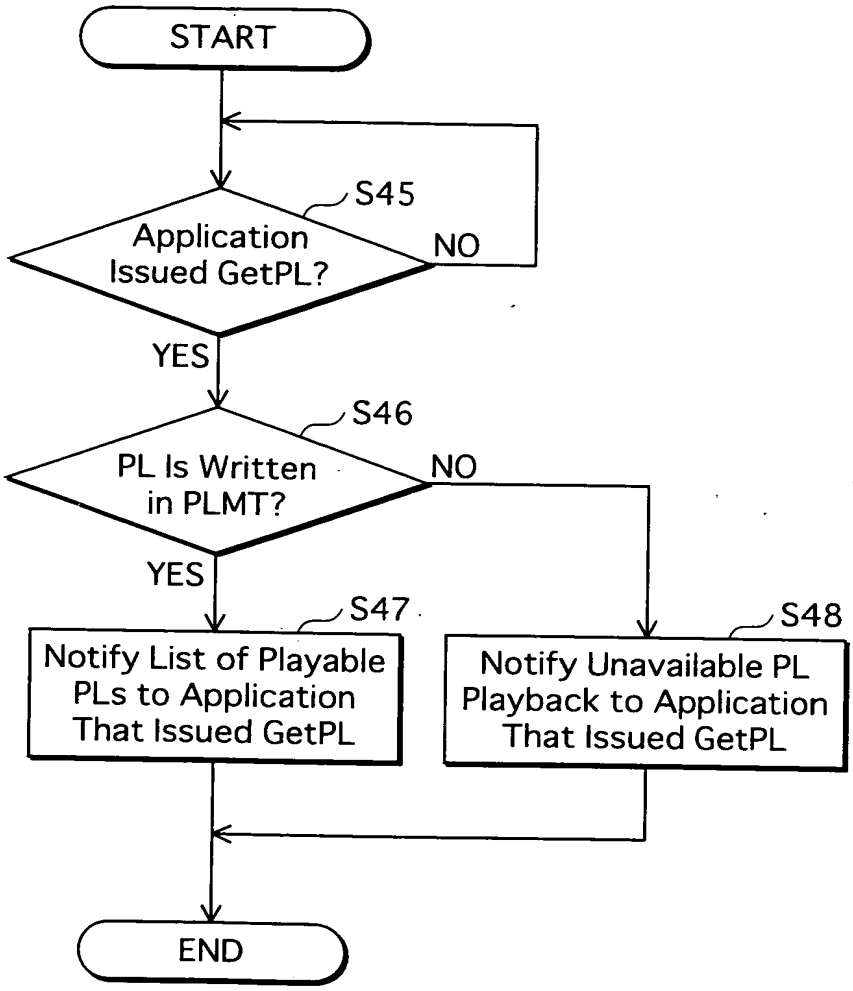

START
S45
Application Issued GetPL?
NO
YES
S46
PL Is Written in PLMT?
NO
YES
S47
Notify List of Playable PLs to Application That Issued GetPL
S48
Notify Unavailable PL Playback to Application That Issued GetPL
END

FIG.47

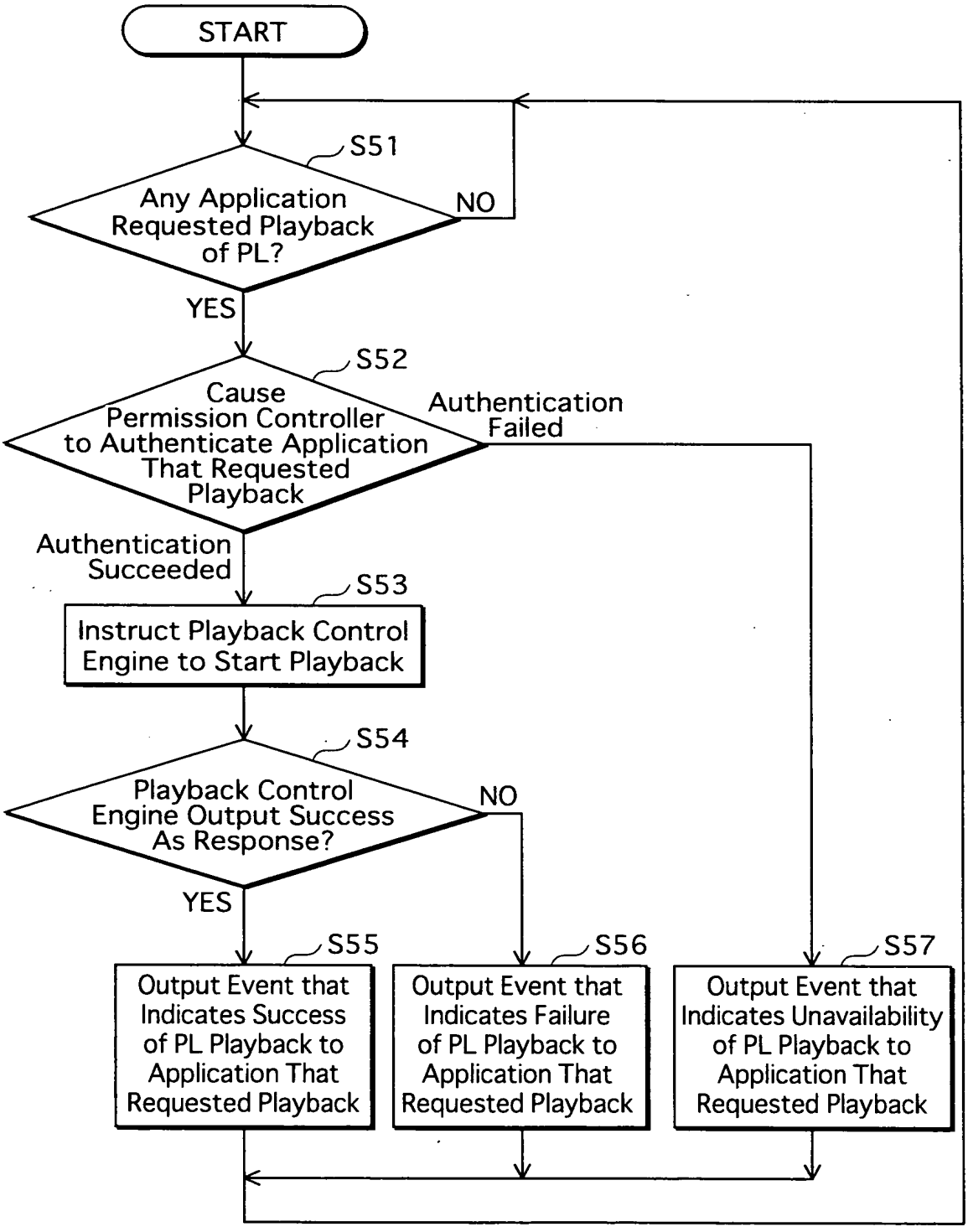

START
S51
Any Application Requested Playback of PL?
NO
YES
S52
Cause Permission Controller to Authenticate Application That Requested Playback
Authentication Failed
Authentication Succeeded
S53
Instruct Playback Control Engine to Start Playback
S54
Playback Control Engine Output Success As Response?
NO
YES
S55
Output Event that Indicates Success of PL Playback to Application That Requested Playback
S56
Output Event that Indicates Failure of PL Playback to Application That Requested Playback
S57
Output Event that Indicates Unavailability of PL Playback to Application That Requested Playback

FIG.48A Selection Algorithm by Parental Level

PSR range	Play List_id_ref
PSR(13)<14	Play List #1
14≦PSR(13)<18	Play List #2
18≦PSR(13)	Play List #3

FIG.48B Selection Algorithm by Language Code for Audio

PSR range	Play List_id_ref
PSR(16)=English	Play List #1
PSR(16)=Japanese	Play List #2
PSR(16)=others	Play List #3

FIG.48C Selection Algorithm by Player Configuration for Video

PSR range	Play List_id_ref
PSR(14)=525×60 TV system 4:3 Letter Box	Play List #1
PSR(14)=525×60 TV system 16:9	Play List #2
PSR(14)=1920×1080TV system	Play List #4

10/549318

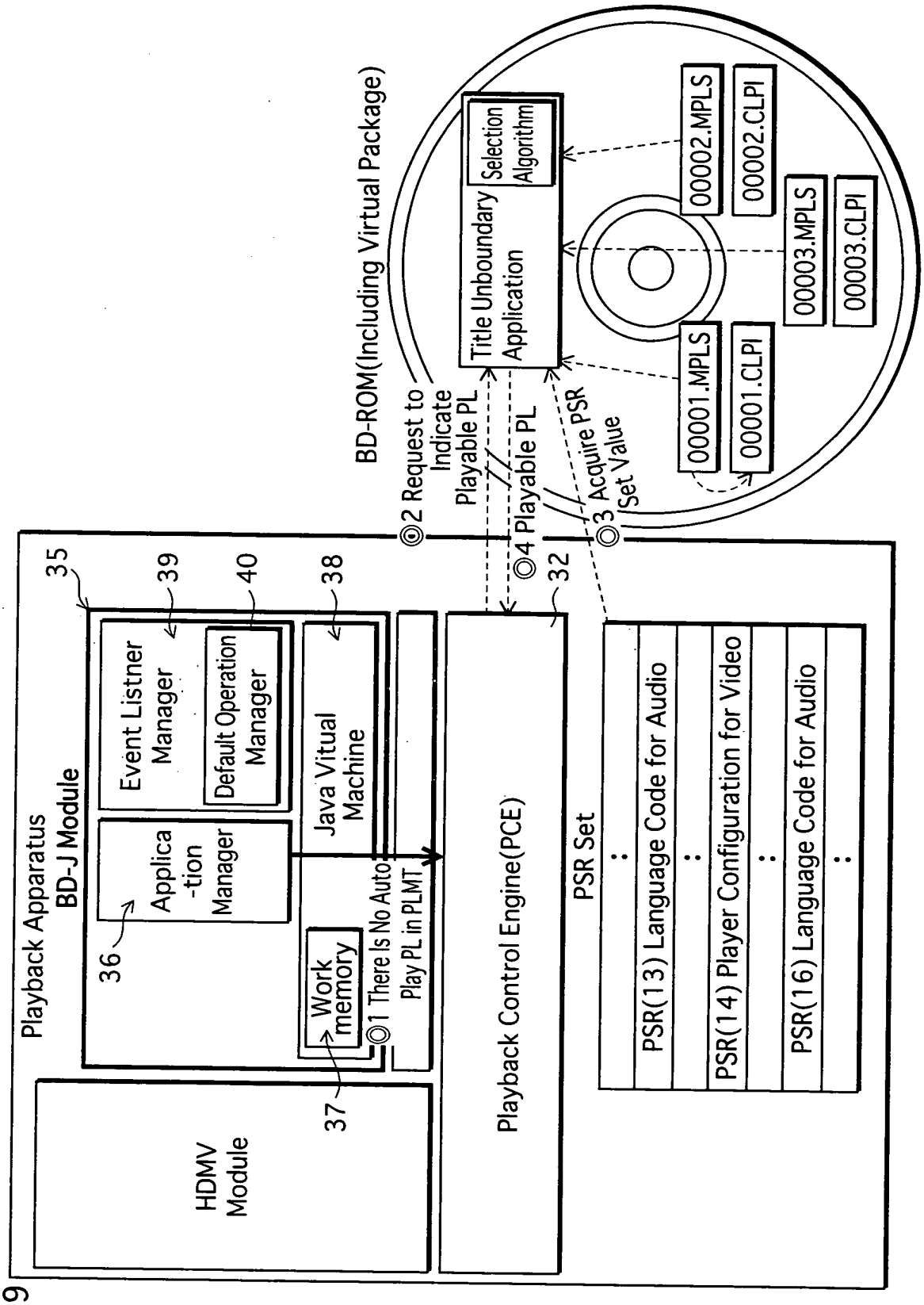

Playback Apparatus
BD-J Module
35
Event Listner Manager
39
Default Operation Manager
40
Java Vitual Machine
38
Applica -tion Manager
36
Work memory
37
HDMV Module
1 There Is No Auto Play PL in PLMT
Playback Control Engine(PCE)
32
PSR Set
PSR(13) Language Code for Audio
PSR(14) Player Configuration for Video
PSR(16) Language Code for Audio
2 Request to Indicate Playable PL
4 Playable PL
3 Acquire PSR Set Value
BD-ROM(Including Virtual Package)
Title Unboundary Application
Selection Algorithm
00001.MPLS
00001.CLPI
00002.MPLS
00002.CLPI
00003.MPLS
00003.CLPI

FIG.49

FIG.50

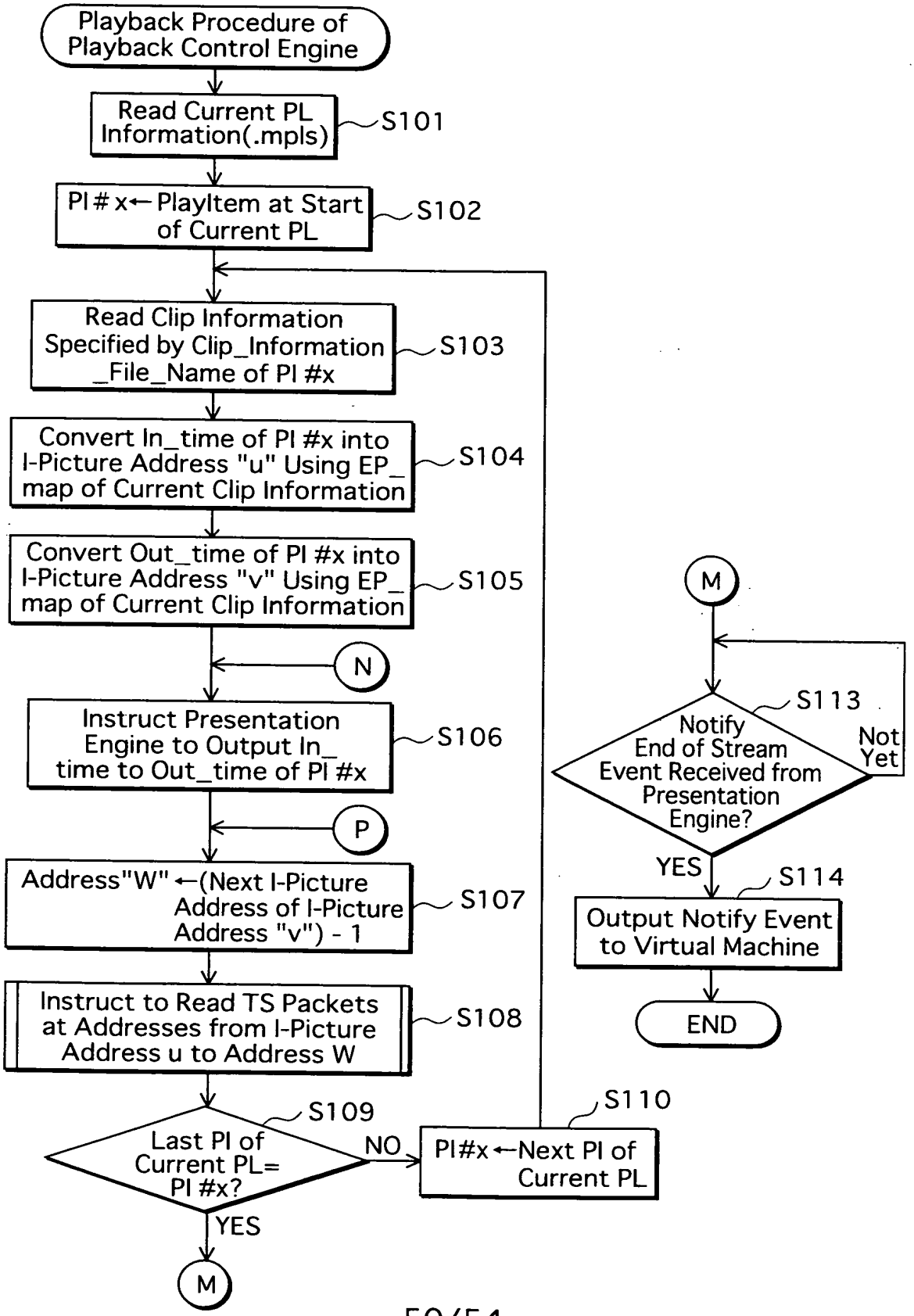

Playback Procedure of Playback Control Engine
Read Current PL Information(.mpls)
S101
PI # x← PlayItem at Start of Current PL
S102
Read Clip Information Specified by Clip_Information _File_Name of PI #x
S103
Convert In_time of PI #x into I-Picture Address "u" Using EP_ map of Current Clip Information
S104
Convert Out_time of PI #x into I-Picture Address "v" Using EP_ map of Current Clip Information
S105
N
Instruct Presentation Engine to Output In_ time to Out_time of PI #x
S106
P
Address"W" ←(Next I-Picture Address of I-Picture Address "v") - 1
S107
Instruct to Read TS Packets at Addresses from I-Picture Address u to Address W
S108
Last PI of Current PL= PI #x?
S109
NO
PI#x ←Next PI of Current PL
S110
YES
M
M
Notify End of Stream Event Received from Presentation Engine?
S113
Not Yet
YES
Output Notify Event to Virtual Machine
S114
END

FIG.51

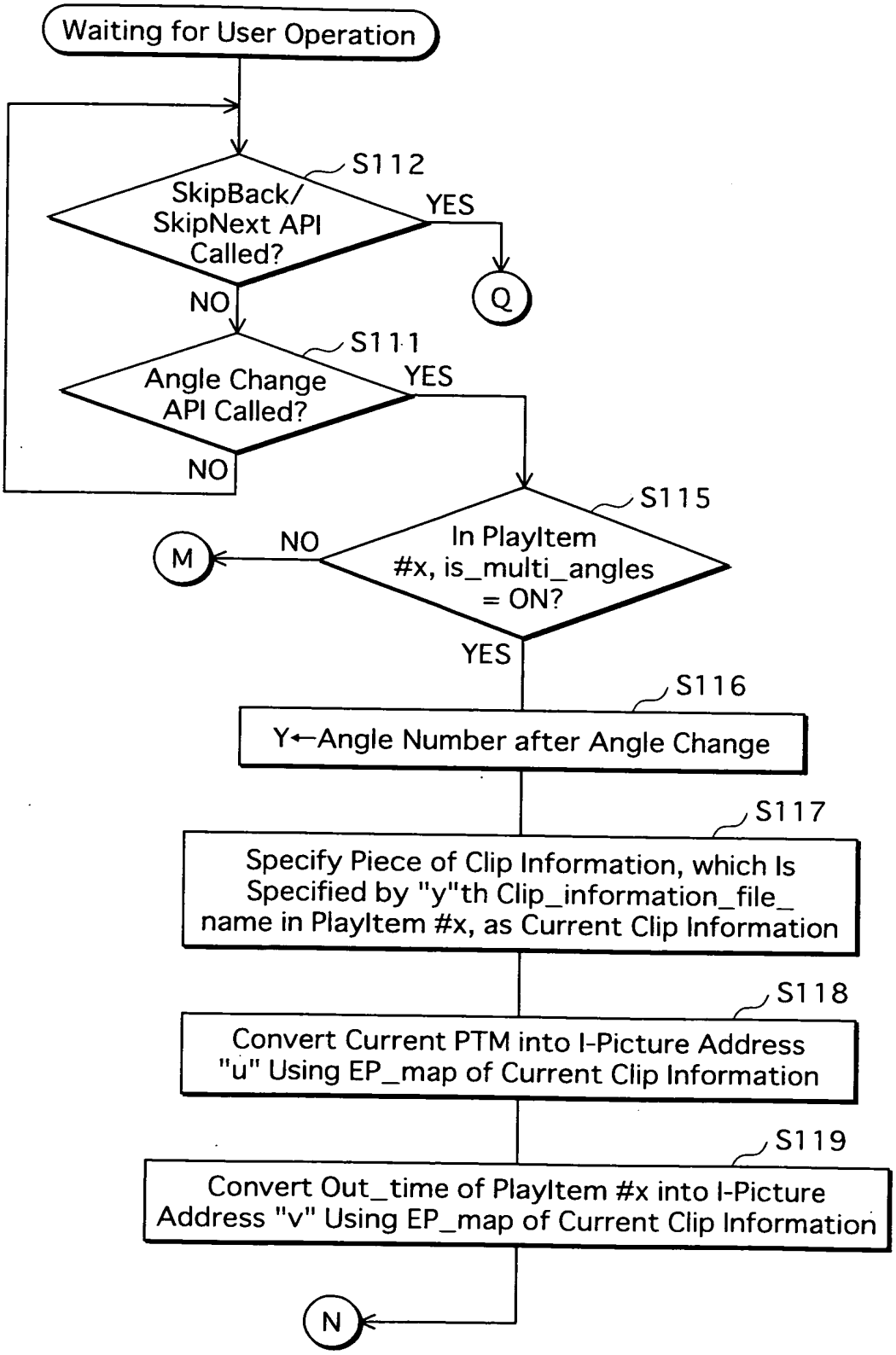

Waiting for User Operation
S112
SkipBack/ SkipNext API Called?
YES
Q
NO
S111
Angle Change API Called?
YES
NO
S115
In PlayItem #x, is_multi_angles = ON?
NO
M
YES
S116
Y←Angle Number after Angle Change
S117
Specify Piece of Clip Information, which Is Specified by "y"th Clip_information_file_ name in PlayItem #x, as Current Clip Information
S118
Convert Current PTM into I-Picture Address "u" Using EP_map of Current Clip Information
S119
Convert Out_time of PlayItem #x into I-Picture Address "v" Using EP_map of Current Clip Information
N

FIG.52

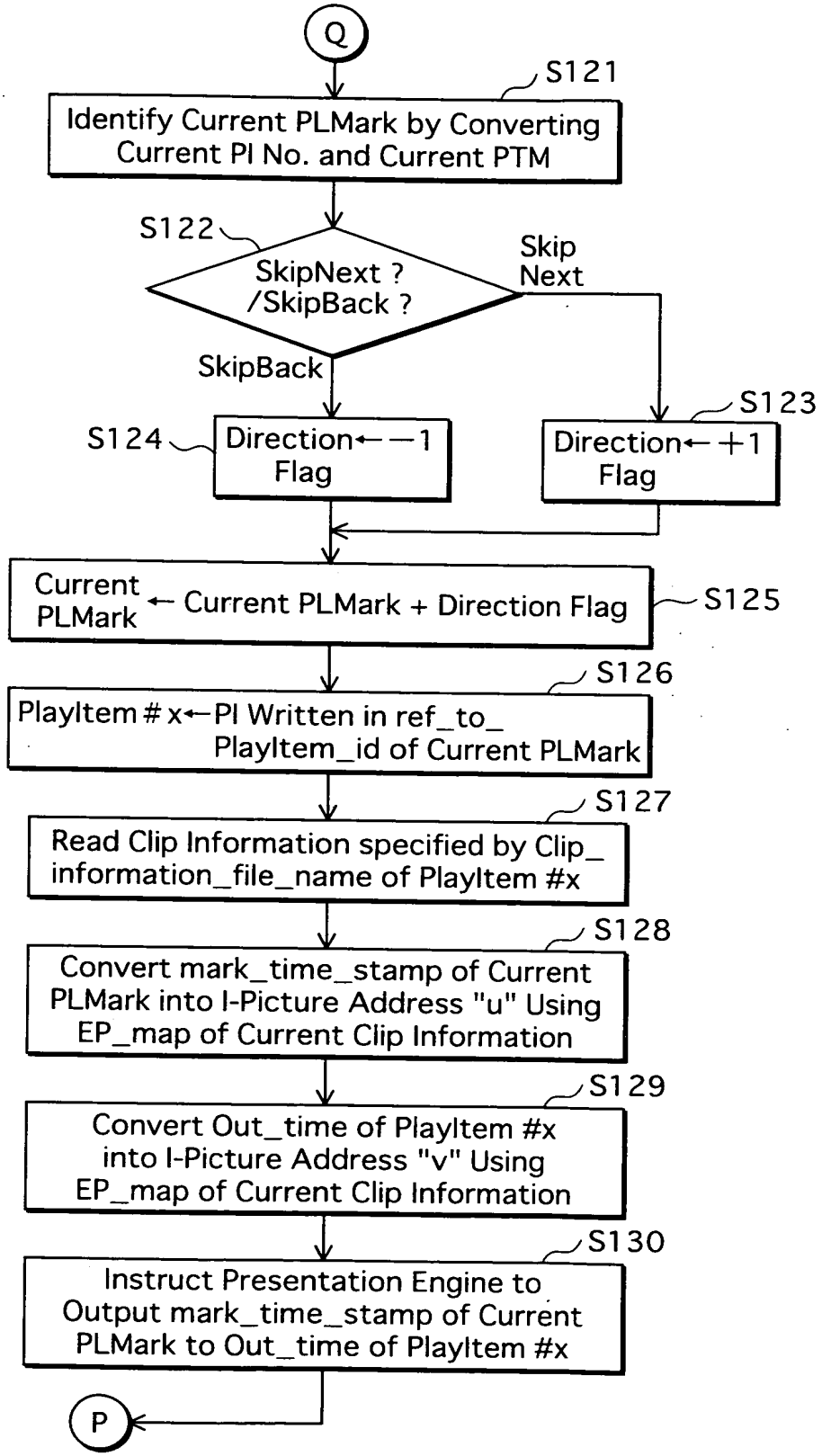

Q
S121
Identify Current PLMark by Converting Current Pl No. and Current PTM
S122
SkipNext ? /SkipBack ?
Skip Next
SkipBack
S123
S124
Direction←−1 Flag
Direction←+1 Flag
Current PLMark ← Current PLMark + Direction Flag
S125
S126
PlayItem # x←Pl Written in ref_to_ PlayItem_id of Current PLMark
S127
Read Clip Information specified by Clip_ information_file_name of PlayItem #x
S128
Convert mark_time_stamp of Current PLMark into I-Picture Address "u" Using EP_map of Current Clip Information
S129
Convert Out_time of PlayItem #x into I-Picture Address "v" Using EP_map of Current Clip Information
S130
Instruct Presentation Engine to Output mark_time_stamp of Current PLMark to Out_time of PlayItem #x
P

FIG.53

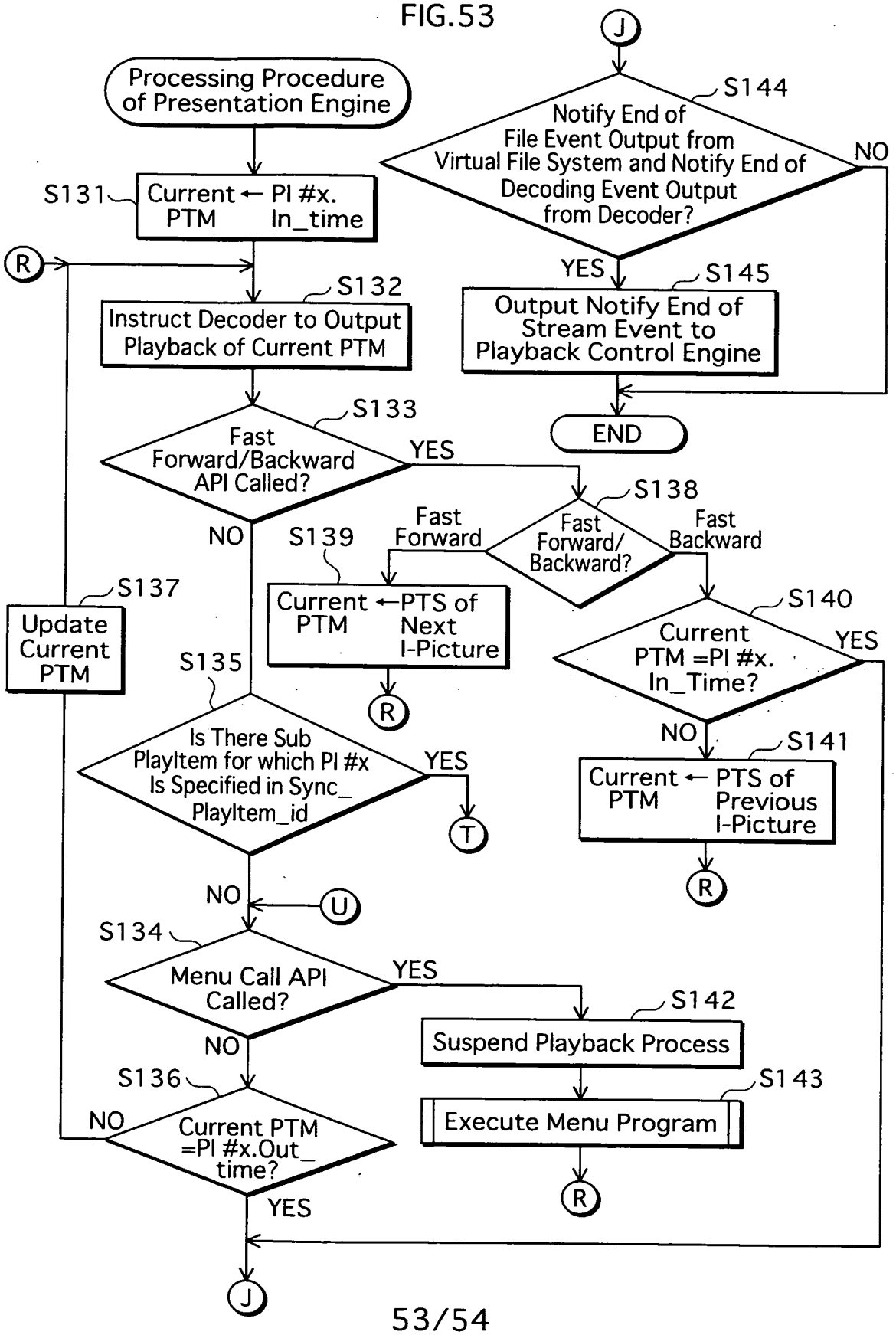
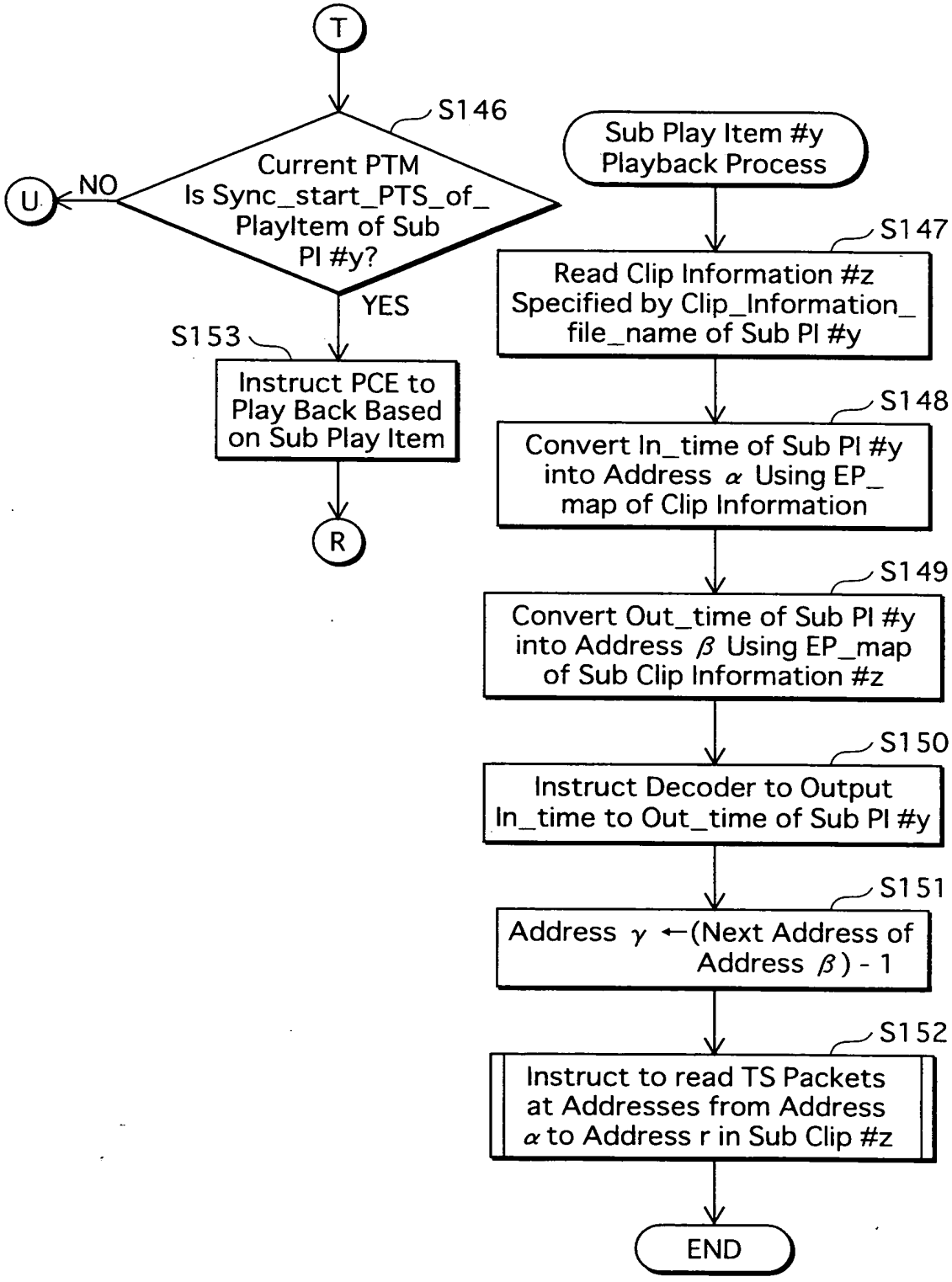

Processing Procedure of Presentation Engine
S131
Current PTM ← PI #x. In_time
R
S132
Instruct Decoder to Output Playback of Current PTM
S133
Fast Forward/Backward API Called?
YES
NO
S138
Fast Forward/ Backward?
Fast Forward
Fast Backward
S139
Current PTM ← PTS of Next I-Picture
R
S140
Current PTM =PI #x. In_Time?
YES
NO
S141
Current PTM ← PTS of Previous I-Picture
R
S137
Update Current PTM
S135
Is There Sub PlayItem for which PI #x Is Specified in Sync_ PlayItem_id
YES
T
NO
U
S134
Menu Call API Called?
YES
S142
Suspend Playback Process
S143
Execute Menu Program
R
NO
S136
Current PTM =PI #x.Out_ time?
NO
YES
J
J
S144
Notify End of File Event Output from Virtual File System and Notify End of Decoding Event Output from Decoder?
NO
YES
S145
Output Notify End of Stream Event to Playback Control Engine
END

FIG.54


T
S146
Current PTM Is Sync_start_PTS_of_ PlayItem of Sub PI #y?
NO
U
YES
S153
Instruct PCE to Play Back Based on Sub Play Item
R
Sub Play Item #y Playback Process
S147
Read Clip Information #z Specified by Clip_Information_ file_name of Sub PI #y
S148
Convert In_time of Sub PI #y into Address α Using EP_ map of Clip Information
S149
Convert Out_time of Sub PI #y into Address β Using EP_map of Sub Clip Information #z
S150
Instruct Decoder to Output In_time to Out_time of Sub PI #y
S151
Address γ ←(Next Address of Address β) - 1
S152
Instruct to read TS Packets at Addresses from Address α to Address r in Sub Clip #z
END